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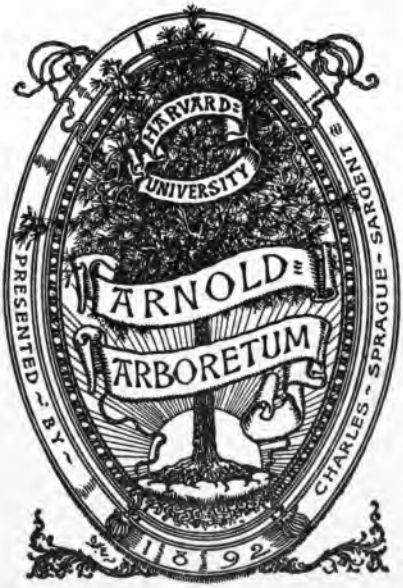

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TRANSACTIONS AND PROCEEDINGS

AND

REPORT

OF THE

ROYAL SOCIETY of SOUTH AUSTRALIA.

VOL. V.

(FOR 1881-82.)

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1882.

Parcels for transmission to the Royal Society of South Australia, from Europe and America, should be addressed "per Mr. W. C. Rigby, care Messrs. Thos. Meadows & Co., 35, Milk Street, Cheapside, London."

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NOTES ON THE ABORIGINES OF NORTH AUSTRALIA.

By PAUL FOELSCHE, Inspector of Police, Northern Territory; Corr. Memb.

[Read August 2, 1881.]

A good deal has from time to time been written about the aborigines of Australia, and a vast amount of information on this subject has been gathered from all the settled parts of Australia; but all that is known of the aborigines inhabiting the northern portion of this continent has been furnished by a few persons who have paid only short visits to the north coast of Australia, and consequently had not sufficient time to get well acquainted with the natives, their habits and customs. I, therefore, venture to supply a few notes on the above subject, such as have come under my observation during eleven years' residence in the Northern Territory. They may be of no great value, but when compared with the valuable paper on the "Aborigines of South Australia," by Mr. J. D. Woods, in the Society's Transactions for 1879, may furnish some information either in support of or against the supposition that the aborigines all round the Australian coastline have sprung from one source, as well as some new facts hitherto not brought under the notice of the Society.

PHYSICAL CHARACTERISTICS.

The few accompanying portraits of men and women of different tribes by way of illustration will show that the physical characteristics of the natives inhabiting the north coast of Australia vary considerably from those in the south, especially as far as the features are concerned. The majority of the men are well built, but the skin is smooth, and the strong covering of hair all over the body so often met with in the south is almost entirely absent on the north coast, at least among those tribes with which I have come in contact; and the growth of hair on the face is very scanty, but on the head it is invariably thick and curly, and I have met with instances where it strongly resembles that of the Papuans, but these are very rare. The women, as a rule, are not so stout as in the south, and with a few exceptions the hair is not so curly as that of the men. The hair of both sexes is, in my opinion, not near so black as in the south; but all this may be the

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results of climatic influences. The mouth, as a rule, is not so wide, and the noses not so flat, although the custom with both sexes of wearing sticks through the nose has a tendency to flatten it considerably. They have good strong teeth, but, as far as I remember, not so beautiful as those of the south. Physically speaking, the strongest tribes I have met with are those on the Alligator Rivers in Van Diemen's Gulf—a great many of the men are over six feet high, and well proportioned. I have only been able to get a few samples of photos. of these tribes, as they very seldom come near the settlements.

LANGUAGE.

Each separate tribe speaks a different language or dialect, but whether they are only a modification of one form of speech or not I am not in a position to state. It is surprising in what remarkable short time all natives learn to speak English. All natives round the coast, from the Coburg Peninsula to the mouth of the Roper River, in the Gulf of Carpentaria, speak the Malay language, acquired by long intercourse with trepang fishers from Macassar, who visit the coast in their prahus during the rainy season, and employ the natives as divers, &c.

LAWS.

Murder is punished with death, except when a native is killed by one of his own tribe, in such case the offender is punished by spearing him severely; but care is taken that he is not mortally wounded. If a native kills one of another tribe, a party of young men is sent out by the tribe of the deceased to kill the murderer if he can be found, if not, one of his near relations has to suffer in his place, and after a lapse of some time that tribe visits the former, and a fight with small reed spears takes place, without any serious consequences, after which the tribes are on friendly terms again.

Disputes between two or more of the same tribe are settled among themselves by fighting it out, if they cannot otherwise agree.

Theft is punished by the offenders, of both sexes, having to submit to being speared, after which—in the majority of cases—they are allowed to retain the stolen property. This is looked upon as a reproach, and the thief generally disposes of the property by giving it to a neighbouring tribe.

Adultery is not much thought of; the woman offender only receives a beating with a small stick, and the male offender has to submit to a small reed spear being thrust through his arm by the suffering husband.

Intermarriage between near relations is looked upon as a grave offence, and is the cause of constant quarrels between the offenders and the other members of the tribe; the former

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are incessantly subject to being speared, which invariably ends in the death of one or both of the offenders. But should they be lucky enough to live till they have an offspring, then all quarrelling ceases, and the marriage is looked upon as legal.

Elopements and stealing of "lubras" are of frequent occurrence, and causes little or no row and fighting. It occurs only among young people, and the old men—who very often have several young lubras—are generally the sufferers. If a young lubra fancies a man, and asks him to go away with her in the bush, there is no quarrelling; but if a man takes or persuades a lubra to run away with him it causes a row, and often ends in fighting. After the parties have cohabited together for a night or two, and like each other, they live together, and after a while return to camp as man and wife. If, on the other hand, they are not pleased with each other, they separate at once, return to camp, and no more is said about it.

In any kind of offence after the law—such as it is—is satisfied, not a vestige of enmity seems to remain, and the matter in dispute is never referred to again. I have never known a second quarrel to arise out of a dispute once disposed of.

MARRIAGE.

There is no ceremony connected with marriage; in the majority of cases it is arranged when the parties are mere infants, and in many instances female children when born are promised to men of all ages; this accounts for so many middle-aged and old men having mere children for wives. As soon as the girl arrives at the age of puberty, and has undergone certain ceremonies, she is handed over to her affianced husband, whether young or old, who takes her to his camp, and she then travels about with him wherever he goes. If the husband is old, he very often has his young lubra stolen from him by a young man who has not been lucky enough to have one given to him, and in some instances young lubras themselves propose to young men to run away with them. If a young man has a sister not promised to any one, he gives her to another man who has a sister similarly situated, whom he takes in exchange. Sometimes, if a husband gets tired of his wife, or she does not suit him, he gives her away to another man, generally to one of another tribe; but such cases are by no means frequent occurrences. I have never heard of a husband selling his wife, perhaps for the simple reason that they have no real or personal property beyond a few spears to give in exchange.

Men often send their wives to each other for one or two nights, or to any favoured individual; this is looked upon as a particular act of friendship.

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Polygamy is universal, and I know natives who have as many as four wives. When a husband dies his wife or wives and children become the property of his brother or next of kin, irrespective of their having a wife or wives of their own, provided the widows are not too old, in that case they remain widows.

There is no restriction as to marriages, except among blood relations; but if parents are of different tribes, the children belong to the father's tribe.

CHILDREN.

The average of births of children is not more than two to each married woman. It is the custom of some tribes, if the wives have more than three or four children, to kill the newborn ones. The reason assigned for this is that they encumber the parents in travelling about for food. Generally speaking natives are very fond of their children. There are very few half-castes, and it is generally believed that many of them are killed, although the natives do not admit this.

CANNIBALISM

Is practised by all natives on the north coast with whom I have come in contact, with the exception of a very small tribe inhabiting the immediate neighbourhood of Port Essington. This tribe is the most civilised on the northern coast, having for years been under the influence of the military who were stationed at the old settlement at Port Essington, which was abandoned in December, 1849. The eating of grown-up people—that is, of natives—is, as far as I can ascertain, not practised. Only children of tender age—up to about two years old—are considered fit subjects for food, and if they fall ill are often strangled by the old men, cooked, and eaten, and all parts except the head, which is skinned and buried, are considered a delicacy. Parents eat their own children, and all, young and old, partake of it. The only instance I have heard where grown-up people have been eaten, was that of two Europeans who were out exploring in the neighbourhood of the Tor Rock, about forty miles inland from Mount Norris Bay; this was in 1874. These unfortunate travellers were, according to the statements of the friendly natives, killed by the "Tor Rock" tribe, cooked and eaten; and from my own knowledge of the natives in that neighbourhood I have no reason to doubt this statement to be correct.

CORROBORIES.

They are of a similar character as in the south, and are performed on various occasions, such as when different tribes visit each other, when members of the tribe die, when returning

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from a friendly visit to another tribe, when they feel inclined to be jolly, when preparing for fighting with another tribe, when portion of a tribe are about to start on some expedition and when they return, and on many other occasions either of friendly or hostile nature. Sometimes these corrobories last all night, and on mostly all occasions the men paint themselves. At corrobories in honour of the dead, men and women paint themselves red, white, and yellow; on all other occasions any colour they fancy, which sometimes takes hours to put on, and covers the whole body, when they very much resemble in appearance the clowns in circuses. Corrobories of a war-like nature are generally held before sundown; for the dead, before and after sundown; and on all other occasions after sundown, whether moonlight or dark.

FUNERALS.

Dead children up to about the age of two years if in good condition are with few exceptions not buried, but eaten; above that age and up to about ten years they are buried about eighteen inches deep in the ground, and are never disturbed. After the body is buried all natives in camp blacken themselves with charcoal, and squat down around a heap of yams prepared for the occasion, which are eaten by all present; after which, if deceased is considered to have been a good boy or girl, they corroborie till sundown. On the next day a short pole about three feet long and six inches thick is put in the ground close to the camp, and painted red, white, and yellow. The natives then paint themselves of the same colours, and in the evening corroborie again for a short time; and next day the camp is deserted—unless it is an old favourite camping place—and locate themselves some short distance away. The painted pole is left in the ground. When young grown-up people die they are rolled up in bark perforated with pointed sticks or leaves to allow the liquid to run through. A corroborie is held, and the body is taken to some chosen tree and put up in the branches, on which bark is laid for the body to rest upon. On this the body is placed, and covered over with bark. They then return to camp and corroborie again; after which a pole, similar to the one put up for children, is planted in the ground and painted as before mentioned, and the natives paint themselves the same colours—red, white, and yellow—and corroborie for three successive nights; after which the camp is deserted, and a new one formed some distance away. When old people die the body is left on the ground till decomposition has well set in, when the body is buried in a shallow grave; up to this time corrobories are held night and morning. After the body is buried corrobories

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are kept up for several nights, all night through, and on these occasions a great deal of red, white, and yellow paint is used by both sexes. After two moons the bones are looked at, and if the flesh is off them they are collected in a basket by old men and put in a tree close to the camp. If the flesh is not off the bones when the grave is opened it is filled up again, and the remains are left undisturbed. The day after the bones are gathered together and put in a tree they are taken into camp, and a corroborie follows. The following night the corroborie is kept up till next morning, and the bones are buried in a small hole about two feet deep. The Port Essington natives have a custom after all the bones have been collected together to carry them about with them in a basket for a long time, sometimes for over twelve months; but this is chiefly done by the women. Sometimes old people, relations of the deceased, at certain times give way to fits of sorrow and grief, which is demonstrated by wailing and lamentation; at the same time they cut themselves with any kind of sharp instrument over the head, arms, and body until large clots of blood cover the wounds.

RITES AND CUSTOMS.

The youths, before being admitted into manhood, have to undergo certain rites and customs, in many respects similar to those practised in the southern colonies. With the exception of the few coast tribes from Port Darwin eastwards to the Liverpool River circumcision is practised by all the tribes with whom Europeans have come in contact; it is performed at about the age of from sixteen to eighteen years, after which they are entitled to all the rights and privileges of the tribe.

The youths of those tribes that do not circumcise have to pass through several stages between the ages of twelve and twenty-four years before they are admitted into manhood. A few tribes have a custom of knocking out one of the upper front teeth. This is done at about the age of fourteen years but does not seem to be compulsory, and the custom appears to be dying out.

In some tribes the young females are subject to some revolting customs before they are allowed to be married or rather allowed to cohabit with their affianced husbands; but these customs are of such a disgusting nature that they are not fit to be mentioned here. Between the ages of twelve and twenty years, both males and females mutilate their bodies by making cuts in the flesh on the upper parts of the arms, just below the shoulder joints, across the chest, body, rump, and thighs, and raise large scars or wheals by way of ornamentation. This is done with a sharp kind of white flint stone, the same as is used for spear heads; they then chew leaves of a native plum-tree,

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and put it in the wound. This is left till it begins to fall off, when the flesh is found to have grown considerably above the surface of the original wound, sometimes to the extent of half an inch; it is then allowed to heal. There is no fixed rule as to how many cuts are to be made on the different parts of the body, but is left to the option and fancy of each individual person.

The septum of the nose is also pierced, but this is done at a very early age; it is done for the purpose of wearing a bone or stick through it as an ornament, but is only worn till they become middle-aged, and never by old people. The only reason assigned for this custom is—giving their own words—"to make young girls and boys look nice."

A singular custom prevails amongst the Larrakeah, Woolnah, Woolwongah, and Irambal tribes, inhabiting the neighbourhood of Port Darwin, Port Patterson, and Daly River. It is to remove the first two joints of the index finger of the right hand of some of the young females when of the age of about two years. There is nothing compulsory about this custom or rite, but is decided by the parents whether it is to be done or not. It is generally believed that females on whom this operation is performed, when grown up, are able to find plenty of yams and other food for their husbands and families.

The operation is performed by making a ligature of large spider webs found in the jungles, which is tightened daily till the joint drops off, when it is buried; the wound is then covered over with chewed leaves of the native plum tree, and in about one month the flesh is grown over the bone and the wound healed. The leaves of this native plum tree, when chewed and placed on a wound, seems to have the property of promoting granulation, for after the finger has fallen off the whole surface of the joint is exposed, and in a month's time it is nicely covered over and healed.

DISEASES AND CURES.

Smallpox.—The disease most dreaded by the natives is smallpox—for which each tribe has, of course, a different name. It makes great havoc among the tribes that get infected. The last time this disease made its appearance on this coast is, as far as I can judge and ascertain, about twenty years ago. According to the tradition of a native living at Port Darwin named "Mangminone," alias Mr. Knight, about 25 years of age, he had the smallpox when a boy of about five years (this man is deeply pitted all over the face), and sometime before the white people arrived at Escape Cliffs—the Hon. B. T. Finniss's expedition in 1864. The disease broke out in the dry season, when the natives burned the grass. Old and young

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were striken down with it, and a great many died, so much so that they could not bury them all, but left the corpses lying about. Among those that recovered were several who became totally blind, and there are now four of these living in this immediate neighbourhood. The disease lasted only during the dry season, from about May to November, and disappeared when the wet season set in. The Port Darwin natives call the disease "Goobimwah," and state it came from the Alligator River tribes, and travelled westward, but how far it went I cannot ascertain; no doubt it spread a long distance inland, as pock-marked natives are found among all the inland tribes.

The tradition of the Port Essington natives of the appearance of smallpox in their tribe is very similar to that of the Port Darwin natives. Some of the Port Essington tribe (called "Yiárick," also "Unállah," now numbering only about thirty all told) who had the disease are still alive, and from information gathered from them it leaves no doubt but that the malady raged there the same time and year it was at Port Darwin. They state it was a long time ago, and a long time after the soldiers had left (the old settlement was abandoned in December, 1849), and came one year shortly after the Malay prahus had started back for Macassar (about the end of May), and when the grass was burned it came from the tribes to the eastward of them, and went on to the Alligator and other tribes to the west of them. Plenty of old and young (and even dogs) died, but by the time the rain came on (about October or November) the disease had disappeared.

One of this tribe named Jack Davis (a name given him by the soldiers), who is very intelligent and speaks English and Malay fluently, informed me that very old people had told him that when they were children smallpox (called by them "Meeha-meeha") killed plenty blackfellows, and adds that by-and-bye, when he will be an old man (he is now about 50), "meeha-meeha" come on again.

Malay prahus, about 30 in number, visit the coast eastward from Port Essington to Blue Mud Bay in the Gulf of Carpentaria every year in search of "beche-de-mer," and have done so in all probability for centuries past. They arrive from Macassar the beginning of January, and leave again the end of May. During the time they are here they employ all the coast tribes trepanging for them, and they all live together; and I think there can be no doubt as to smallpox having been brought to these shores by them, and on the last occasion by a prahus that visited the Gulf, for they leave so soon as the South-East monsoon has fairly set in, and shortly after the prahus had left the disease appeared, coming up the coast from the Gulf with the S.E. winds, as stated by the natives, and

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travelled through all the tribes to the westward. Is it not likely that this terrible disease, "the smallpox," was introduced here by these trepang-fishers some hundred of years ago, and then spread gradually all over the Continent?

The remedy the natives apply to cure smallpox is a thick milky-looking juice obtained from a leafless vine* found along the shores of mangrove flats. It twines in among other bushes, and is called by Port Darwin natives "Gaoloowurrah." This juice is put on the sores, and left till it forms a scab, which is washed off so soon as it gets loose, when the sore is found to be healed, the skin is white, and takes about a year to attain its natural colour. This remedy is said to be a sure cure, although some who used it lost their eyesight; but strange to say some patients object to having it applied, but why they cannot explain.

Fever.—Malarious fever is very prevalent among the natives, but they do not seem to have any remedy for this complaint, and it terminates fatally in many cases.

Boils are also frequently met with, and affect young andold alike. So soon as they make their appearance they are poulticed with leaves and hot water till they break.

Coughs and Colds are very common complaints among the natives, which they cure by eating a kind of grub found in mangrove trees, and drink the liquid with which the grub is surrounded when in the wood. This grub resembles very much the common earthworm.

Ringworm, or a very similar disease, is a plague from which the natives in the neighbourhood of Port Darwin suffer greatly. This disease spreads over large portions of the body, and I have seen the whole of the abdomen covered with it as well as the greater portion of the back. The natives say the Woolnahs bring this disease from the Adelaide River. It certainly seems to be very local, for it is not known at Port Essington, nor west of Port Darwin. The Alligator and Adelaide Rivers and Port Darwin tribes seem to be the only ones troubled with this complaint. The only remedy applied is to put the affected parts close to a brisk fire till the skin gets scorched, which they say kills the disease.

Syphilis is occasionally met with, but it is by no means common among the natives. I have seen only a few cases during the eleven years I have been here.

Venereal disease is rather prevalent, and they have some means of curing it.

Broken limbs are set with a good deal of skill and placed

* On my recent visit to the Northern Territory, the plant, which was shown to me by a native in company with the author, proved to be *Sarcostemma australe*, R. Br.—*R. Tate.*

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in a kind of splint made of strips of bamboo and fastened together with string made of the bark of Banyan trees, and large enough to go round the injured limb. It is then tightly secured with string, and left till the break or fracture is healed. Should inflammation set in the part is bathed with hot or cold water.

Neuralgia is cured by making a poultice of the fruit of the red *Eugenia*, if obtainable, by roasting them in the fire, mashing them up and putting it while hot on a piece of soft bark (paper bark), which is placed over the affected part till all the moisture is absorbed and the poultice quite dry, when it is replaced by a fresh one. According to the statement of the natives, the second application invariably cures the complaint.

Gatherings in the ears, from which the natives suffer a great deal during the wet season from lying on the wet ground, is also treated with the above-mentioned fruit by squeezing the juice after the fruit is roasted into the ear.

Lunacy in a mild form is occasionally met with, and the natives have great faith in the application of iron bark and native plum-tree leaves heated over a fire, with which the whole head and face is covered.

Wounds are not much thought of, and are treated in various ways. Spear-wounds are generally stopped up with pounded bark of the native plum-tree, to keep out the air; fresh boiled urine is freely applied, which generally heals the wound, unless internal injury has been received.

Cut wounds and old sores, especially of a constitutional nature, are treated with a resinous substance of a blood-red appearance, called by the Port Darwin natives "gneváylah," and is obtained from a Eucalyptus tree. When taken from the tree it is generally very hard, but when put in water and squeezed it gets soft like putty. It is well washed, and all the dirt removed. It is then spread thickly on a piece of paper-bark like a plaster and applied to the wound or sore; and it is left on till it gets dry, which it does in a few days, when it is easily taken off; and if the wound is not closed, fresh plaster is applied until the sore is healed up. Fresh wounds are also treated with the scraped bark of a bush called by the Port Darwin natives "malimgarrácah." It is soaked in urine, and applied to the wound. The juice obtained from the bark of the milk tree, and called "gaolooanúlkah," is said to possess extraordinary healing properties. It is applied to the wound with the finger, and is very sticky. The natives state this juice destroys the eyesight if a drop should get into the eye, and they always shut their eyes when cutting the bark to get the juice.

I have a native in my employ who had a good-sized sore on

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his foot which, according to his own statement, came of its own accord. Our medical officer here attended to it for upwards of six months; occasionally the wound got smaller, but always opened out again, and would not heal up. At last the native got tired of this treatment and applied the resinous substance mentioned above. At this time the wound was about one-and-a-half inches long and three-quarters of an inch wide, but not deep; in about a fortnight's time he removed the plaster, when the wound was properly healed.

Snakebite is treated by putting ligatures some distance above and below the wound, and then open the largest artery in the vicinity of the bite with a sharp stone, shell, or other sharp instrument; several incisions are made until copious bleeding is the result, the ligatures are not removed for two or three days, when the patient is all right. I have never heard of a native dying from a snakebite.

On inquiry why the cuts are not made immediately over the bite, it was explained that the poison entered numerous small blood vessels which all run into larger ones through which it is disseminated through the whole body; thus it shows the natives have some knowledge of the anatomy of the human body. Bleeding is considered a cure for all sorts of pains in the head or limbs, and is resorted to very freely. This paragraph on diseases and their cures relates more particularly to the tribes in the neighbourhood of Port Darwin.

Doctors.—The tribes in the neighbourhood of Port Darwin have all recognised doctors, consisting of both men and women, but their knowledge of diseases is very limited, and the remedies they apply are very few, and what they cannot cure with them, they pretend to cure by charms. The remedies for diseases described in the preceding paragraphs are known to and practised by nearly all the elder members of the tribes, and acknowledged doctors pretend chiefly to cure internal diseases.

These doctors teach their pretended knowledge only to their own children, who again teach their children. This accounts for there being female doctors who are considered to possess all the qualities the men doctors do.

HUMAN FAT.

Nearly all natives use fat obtained from dead bodies of either their own or other tribes for anointing themselves with, which they believe makes them strong and able to fight well. The fat taken from all parts of the body is mixed with red ochre to prevent it melting away. It is then tied in paper-bark, and in this state is distributed among the men, and very often some is sent to other tribes. It is not used by women, nor have I ever heard of its being eaten.

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WEAPONS AND CANOES.

The weapons are similar to those in the southern colonies, but shields and boomerangs are not used. The principal weapons are clubs and spears. The latter are of great variety. Some shaped out of solid pieces of wood are thrown by hand without the aid of woomerahs or throwing sticks. Poisoned spears are not used.

Canoes are made of bark, of similar size as in South Australia; but the ends, instead of being bent up, are cut slanting and neatly sewed together with fine strips of bamboo, giving them a sharp stem and stern. The gunwales are made of bamboo, thereby being nicely shaped. They are propelled through the water by small hand-paddles at a great speed. The Port Essington natives have acquired the knowledge of cutting canoes out of a solid tree from the Malays visiting that part of the coast every year trepang-fishing, from whom they also obtain the necessary tools for that purpose. Weapons and canoes form the only real property the natives possess, but do not accumulate them.

ROYAL FAMILY.

None of the natives on the north coast that I have met with have a recognised king or royal family, but the old men seem to be the rulers of the tribe, to whom all cheerfully submit. Any one individual distinguishing himself in war or in any other way is looked upon as a great man, and takes a prominent part in all disputes with other tribes.

SUBSISTENCE.

Australian natives in their wild state rarely provide for the morrow, and seem to have no idea to make provision for the future, and to this those inhabiting the northern portion of the continent are no exception. They start on a journey without a thought as to where the next meal is to come from, but as Nature has in this part of Australia provided a plentiful supply of reptiles, game, fish, &c., they procure sufficient as they travel along by the time they feel hungry.

Native yams grow plentifully in many places, and are much sought after as food, as also the roots of lilies growing in swamps and lagoons.

Their mode of procuring food is not attended with so much difficulty as people unacquainted with natives in their wild state imagine. Fish being plentiful in rivers, creeks, waterholes, and lagoons, it forms a principal part of the native food, especially along the coast. Large fish are speared, and at low tides small fish are left in holes on the reefs, and are easily caught; as also large crabs, which are plentiful. If they

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cannot spear fish in waterholes or creeks, they strip the bark of certain trees, which is pounded with stones till the fibre gets soft. It is then put in the waterhole, which after a little while has the effect of stupefying the fish, and they float on the surface, when they are gathered up. Torches are employed by night, by which the fish are attracted and speared. Small nets made of the fibre of the bark of Banjan trees are also used for catching fish. Snakes, lizards, &c., are knocked over with sticks and stones. In the dry season the grass is set on fire, when all kinds of reptiles and other animals are easily secured.

Kangaroos generally have regular beaten tracks or paths leading to water, on which they are waylaid and speared.

Ducks and geese are killed in various ways. While feeding in swamps, the natives armed with short sticks crawl up to them among the rushes, and when near enough throw the sticks among the flock, which generally cripples some. The natives also climb up high trees near swamps, and with small sticks kill geese flying over to their feeding ground. But the more ingenious method of catching ducks and geese is to go into the water some distance from where the game is, cover their heads with lilies and leaves growing in the water, and then work their way with just their eyes and nose above water up to the game, which is seized by the legs and pulled under water. This method of catching game is also practised on the shores of Lake Alexandrina, in South Australia.

Another method of catching geese—which at certain times of the year are very plentiful—is to build a small bell-shaped hut among the rushes and swamps visited by geese. The hut is constructed of rushes, and a few holes just large enough to admit the body of a goose are made round the bottom of the hut. In these holes are placed young lilies and roots, on which the geese feed. A native then gets into the hut and closes it in at the top. The geese come feeding about the hut, and seeing the lilies and roots, put their head through the hole to get them, when the native inside the hut seizes them by the head, pulls them through the hole, and twists their neck off; others seeing their mates disappearing through the holes have a look in also, and are treated in the same way, and great numbers are caught sometimes by this simple process. Turtle, geese, and alligator eggs in all stages and condition are delicacies, and much sought after.

Yams of different kinds are, when in season, a considerable item of food for the natives. Some of these yams when eaten raw cause the mouth and throat to swell, accompanied by great pain. These yams have to be specially prepared to render them eatable. To do this a hole is scraped in the ground, which is paved with stones. A large fire is then made in the hole till

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the stones are of a sufficient heat, when it is cleared out and the yams put in it. They are then covered over with leaves, and over all from four to six inches of earth. It is then left till next day, by which time the yams are cooked and all the noxious substance has disappeared.

Shellfish of all descriptions form an important part of subsistence to natives on the coast.

The natives' mode of preparing their food is very simple. Everything that requires cooking is prepared on hot coals; small animals are cooked whole; large ones, such as kangaroo, are torn in pieces and then cooked, and not the smallest particle is wasted.

Native fruits (not plentiful), roots of lilies and rushes, and tops of the cabbage palm, are eaten raw.

ORNAMENTS.

The ornaments worn by the natives consist of a stick through the septum of the nose, a sort of wig made of the hair of natives of other tribes, which is exchanged for that purpose. Kangaroo teeth are fastened on to locks of hair with a resinous substance used for fastening stone spear-heads on to bamboo shafts; the heads of small birds and ducks' bills are fastened on to the hair; bunches of white feathers fastened on to a short painted stick are stuck in the hair; and a narrow strip of bark painted white is tied across the forehead. Necklets made of grass stems cut in half-inch lengths, representing beads, are put on strings and worn round the neck; also long tassels with small tufts of feathers are fastened to the hair on each side of the head; the same kind of tassels are also fastened on to the elbows, and rings of grass are plaited round the arms above the elbow, round the wrists and fingers. Painted belts made of bark, and some of female hair, are worn round the waist, but all these ornaments, with the exception of a stick through the nose, kangaroo teeth, and ducks' bills in the hair, necklaces and armlets, are exclusively worn by the men, who also wear a large tassel about nine inches long and six inches wide to cover their nakedness. The Port Essington natives and those along the coast as far as the Roper River wear also ornaments made of proper beads obtained from the Malays visiting the coast.

SIGNALLING.

The natives have a system of conveying messages to each other at considerable distance, almost as far as they can see each other, by means of signs made with the arms. This system of telegraphing is greatly practised, even when at speaking distance, and consequently some are quite experts in

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the art. It has been asserted that Masonic signs have been discovered among the natives in North Australia; but during my whole eleven years' residence here, during which time I have come in contact with a great many different tribes, I have noticed nothing approaching to Masonic signs, with which I am well acquainted. No doubt the above-mentioned system of telegraphing has been mistaken for these signs.

DRAWINGS

By natives are met with among all tribes, generally representing existing objects. The only imaginary object I have seen painted is the so-called "Devil-devil" (appellation borrowed from Europeans), an evil spirit in whose existence all natives believe, but for whom each tribe has a different name. Natives are constantly in dread of this evil spirit when travelling in the bush.

ORIGIN.

I once listened to a conversation between a Port Darwin and a Port Essington native. Being of different tribes, and speaking different languages, they commenced in broken English, which both spoke fairly. The subject of conversation was the origin of their race. Being at that time well-acquainted with the tradition of the Port Essington natives as to their origin, I felt anxious to obtain what information I could from the Port Darwin native on the same subject, and on questioning him he stated that he knew very little about it, but that "Lirrawah," of the Southport branch of the Larrakeah tribe, could give me the whole history, but that he was very reluctant to communicate to the other blackfellows. This native is a doctor, and held in great esteem by the whole tribe as a learned man, who, as they term it, "knows plenty all about." I embraced the first opportunity of "Lirrawah's" visit to Port Darwin to gain what information I could from him on the origin of his race, and on the promise that I would not tell other blackfellows, elicited from him the following disjointed statement:—A very good man, called "Mangarrah," lives in the sky among the stars, a place called "Teelahdlah." He made all living creatures upon earth, except blackfellows. He also made the trees, grass, water, and everything; and makes wind, rain, and thunder. He never dies, and likes all blackfellows.

Another good man called "Nangánburrah" lives in the bowels of the earth, a place called "Ahbybúggah." He a long time ago made one blackfellow, called him "Dawed," and taught him how to make blackfellows. "Dawed" made plenty of boys and girls, who grew up and multiplied. When "Dawed" was an old man the blackfellows growled plenty,

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and would not do what he told them; he then made them very ill, and plenty died, but some got better. "Dawed" then caught some geese, and told blackfellows to eat them, but some old women refused, saying the geese were no good; "Dawed" then made the first spears, and speared the old women in the legs, when a strange blackfellow called "Shares" appeared, helped the old women, and took them to his own country called "Tooparánlah;" "Dawed" followed him, and demanded the women back again, which was refused. "Shares" and these women had plenty of children, which now form the "Woolwángah" tribe, inhabiting the country between Southport and Pine Creek. "Shares" was a bad man, and when he died turned into a large stone in the Pine Creek country. This stone the natives state is situated on a large creek, and is much feared by them. They say any one touching it will soon die.

"Dawed," when he found he could not get the women back again from "Shares," went to "Língowah," a place on the Adelaide River, where he saw a beautiful young girl called "Abmáhdam." He liked her, but she refused to go with him; he then sent something from his own person which had the appearance of a snake. This fetched the girl to him, and he had intercourse with her.

"Dawed" then went back to his own country, and the girl remained on the Adelaide River, where, in course of time, she had plenty of babies, who grew up and now form the "Woolnah" tribe on the Adelaide River.

"Abmáhdam" afterwards died, and turned into a tree at a place on the Adelaide River called "Layláyloo." "Dawed," after making all about blackfellow, died and also turned into a tree on the Adelaide River at a place called "Ahlee áhlee." These trees, the natives assert, are still growing on the Adelaide River, and are much reverenced, for "Dawed" and "Abmáhdam" have been good people. Near the place where "Dawed" turned into a tree, when he died, there is a large waterhole highly reverenced by the natives, who believe that sick persons bathing in this water get cured. "Dawed" also taught all the blackfellows how to make the different kinds of weapons and all the other things which blackfellows are now making.

"Nangánburrah," who lives in the ground, is designated "all same Government." He can read and write, and when blackfellows growl write it down in a book. When blackfellows die they go down into the ground to "Nangánburrah," and if they have been good, which is ascertained by referring to the book, "Nangánburrah" gives them a letter to give to "Mangarárrah," with whom they then live among the stars. If they have been bad and growled they are sent to a place deep down in the ground called "Ohmar," where there is

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plenty of fire; and long way under this place is a large water called "Búrcoot," where one blackfellow named "Mádjuit-Mádjuit" sits down. He regulates the tides according to the changes of the moon. He, like "Mangarárrah" and "Nangánburrah," never dies.

The tradition of the natives in the neighbourhood as to their origin is as follows:—A long time ago a big woman called "Warahmoorúngee," in a state of pregnancy, came from the North, there being no water on earth at that time. She arrived at Port Essington, and finding it to be a good country she made a large fire in the ground, which, when burned out, made the sea and all the water. She then left plenty of blackfellows of both sexes and went further away into the bush, made more water and left more blackfellows, and gave each tribe a different language. After this she left a fire in the ground a long way in the bush, and set three blackfellows to watch it to prevent it breaking out. Should they neglect to look after it the fire will come and burn all blackfellows. "Warahmoorúngee," after walking about a little longer, died and turned into a stone a long way in the bush.

These natives have no idea of a future state of existence.

Note A.

Melville Island, about 30 miles north of Port Darwin, is inhabited by a tribe of which very little is known. They do not circumcise, and speak a different language from those on the mainland. They are represented as a very strong and powerful race.

Before the arrival of the Hon. B. T. Finniss at Escape Cliffs, in 1864, the Melville Island natives occasionally visited the mainland for the purpose of stealing lubras, in which they invariably succeeded; but they have not done so since. This tribe is of a very hostile nature, and on several occasions have attacked Europeans visiting the island. Their canoes and weapons are similar to those on the mainland.

Note B.

A tribe or tribes inhabiting the western coast of the Gulf of Carpentaria, and for about 100 miles inland, between the Roper and Nicholson Rivers, have a most disgusting and unnatural practice of slitting the penis along the urethra from its opening right down to the root. When about the age of fourteen years the youth are circumcised by the old men without any particular ceremony or formality, and when about eighteen years old the operation of slitting up the urethra is performed on those selected for that purpose. It is done with

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a sharp shell or mussel, and sometimes with a white flinty kind of quartz, which is procured from some distance under ground, and the hole is carefully covered up again. After the operation a small stick or bone is placed in the canal to keep it open. As the wound heals the penis shrivels up, and has, in its collapsed state, the appearance of a large button. According to the statement of the women the men so operated upon cannot beget children, although able to have connection with them, and for that purpose are preferred to the others. It appears that the strongest and able-bodied youths are generally selected for this operation, which is considered an honour among the tribe.

For the information on this subject I am indebted to Mr. George de Lautour, who has on several occasions travelled through these tribes, and at my request collected the above information.

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Plants Indigenous to the Neighbourhood of Hermannsburg,

on the River Finke, Central Australia.

Collected by the Rev. H. Kempe, Corr. Memb.

[Named by Baron F. von Mueller, K.C.M.G., F.R.S., &c., Hon. Fellow.]

[Read February 7, 1882.]

Encouraged by Baron F. von Mueller, who informs me that the most common plants have been sent in by me, I continue the list of plants indigenous to this part of Central Australia, which was commenced in vol. 3 of the Society's Transactions, pp. 129 to 137. The present communication gives the names of the species identified by Baron F. von Mueller, which had been sent to him during the course of the year 1881. The names of a good many critical species, not always obtained in a state of perfection, are still to be expected.

It may be interesting to know that all the country round here consists of limestone. Even where there are sandhills the underlying rock is limestone, so that nearly all the soil is calcareous. The James and MacDonnell Ranges are made up of red sandstone (in my opinion Tertiary sandstone) and granite. The southern hill of the MacDonnell Ranges consists of a sort of conglomerate.

DICOTYLEDONOUS PLANTS.

Cruciferæ.

Stenopetalum velutinum, F. M., and *S. lineare*, R. Br.; both growing chiefly on hard loamy soil.

Pittosporeæ.

Pittosporum phillyroides, De Cand.

Sterculiaceæ.

Commerconia magnifolia, F. M., a perennial shrub, growing near the Ranges. *C. Kempeana*, F. M., grows only on sandhills.

Hannafordia Bissillii, F. M., perennial shrub, growing on the Ranges.

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MALVACEÆ.

Hibiscus Sturtii, Hooker, only on rocky tracts. *H. Farragei*, F. M., in the bed of creeks.

Gossypium australe, F. M., on the Ranges; stem annual only here.

Abutilon otocarpum, F. M., and *A. cryptopetalum*, F. M., stems annual, growing everywhere.

Sida virgata, Hooker; *S. rhombifolia*, Linné.

Plagianthus glomeratus, Bentham; by springs only, stem annual.

URTICACEÆ.

Ficus platypoda, Cunningham, the native fig-tree; only on and near the Ranges.

SAPINDACEÆ.

Heterodendron oleifolia, F. M.; a very pretty tree, growing on rocks as well as on sandhills.

ZYGOPHYLLEÆ

Tribulus terrestris, Linné.

FRANKENIACEÆ.

Frankenia laevis, Linné; on hard stony ground.

AMARANTACEÆ.

Alternanthera nodiflora, R. Br.; *Achyranthes australis*, R. Br.; *Ptilotus alopecuroides*, F. M.; and *P. incanus*, Poiret; all growing everywhere.

SALSOLACEÆ.

Rhagodia nutans, R. Br.; *Chenopodium auricomum*, Lindley; *Kochia aphylla*, R. Br.; *K. lanosa*, Lindl.; *K. brevifolia*, R. Br.; *Chenolea sclerolaenoides*, F. M.; *Babbagia dipterocarpa*, F. M.; *Atriplex nummularium*, Lindl.; *A. velutinellum*, F. M.; *A. holocarpum*, F. M.; and *Salicornia leiostachya*, Benth. Most of these plants are good food for sheep; they grow even on the most arid places.

FICOIDEÆ.

Mollugo Cerviana, Ser.; a small annual, growing only after heavy rains.

POLYGONACEÆ.

Polygonum plebejum, R. Br., and *Muehlenbeckia Cunninghami*, F. M.

LEGUMINOSÆ.

Mirbelia semiseptosta, F. M.; on the Ranges. *M. oxyclada*, F. M.

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Templetonia egena, Benth.; a perennial shrub.
Psoralea eriantha, Benth.; *Swainsonia phacoides*, Benth.
Erythrina vespertilio, Benth.; a large tree in the Ranges.
Acacia sentis, F. M.; *A. minutifolia*, F. M.; *A. Farnesiana*, Willd.; *A. aneura*, F. M.; *A. pyrifolia*, De Cand.; and *A. salicina*, Lindl.

HALORAGEÆ.

Myriophyllum verrucosum, Lindl.; only in water.

MYRTACEÆ.

Eucalyptus terminalis, F. M.; *E. tesselaris*, F. M.; and *E. rostrata*, Schl.

RHAMNACEÆ.

Ventilago viminalis, Hooker, and *Spyridium spatulatum*, R. Br., are perennial shrubs, the latter growing only in the Ranges.

CUCURBITACEÆ.

Cucumis acidis, Jacq.; *Mukia scabrella*, Arn.

STACKHOUSIACEÆ.

Stackhousia muricata, Lindl.

THYMELEÆ.

Pimelea microcephala, R. Br.; perennial shrub, growing only in shady places.

PROTEACEÆ.

Grevillea striata, R. Br.; a large tree attaining a height of 100 feet.

LORANTHACEÆ.

Loranthus Exocarpi, Behr.; *L. pendulus*, Sieber, *et var. canus*, F. M.; and *L. linophyllus*, Fenzl.

SANTALACEÆ.

Santalum acuminatum, A. De Cand.
Exocarpus spartea, R. Br.; a perennial shrub in the Ranges and on the sandhills.

RUBIACEÆ.

Pomax umbellata, Sol.

COMPOSITÆ.

Minuria Cunninghami, Benth.; *Calotis microcephala*, Benth.; *C. Kempei*, F. M.; *Polycalymma Stuartii*, Sond. and Muell.
Siegesbeckia orientalis, Linné.
Millotia Kempei, F. M.; a small annual growing on sandhills.

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Helichrysum Kempei, F. M.; *Helipterum pterochætum*, Benth.; *H. moschatum*, Benth.; *H. Charsleyæ*, F. M.
Senecio odoratus, Hornem; *Bidens bipinnata*, Linné.

GOODENIACEÆ.

Goodenia cycloptera, R. Br.; *G. sepalosa*, F. M.; *G. Vilmoriniæ*, F. M. These lovely little plants grow here almost everywhere after a good rain.
Scævola depauperata, R. Br.

ASCLEPIADEÆ.

Marsdenia Leichhardtiana, F. M.; a creeping plant, the fruits of which are eaten by the aborigines.

SOLANACEÆ.

Solanum ferocissimum, Lindl.; *Datura Leichhardtiana*, F. M.
Duboisia Hopwoodii, F. M.; the leaves of this shrub are used by the natives to poison emus.

CONVOLVULACEÆ.

Convolvulus erubescens, Sims.

BORAGINEÆ.

Heliotropium pleiopetalum, F. M.; on sandhills.
H. undulatum, Vahl.

VERBENACEÆ.

Newcastlia spodiotricha, F. M.; on sandhills only.
Verbena macrostachya, F. M.; in the bed of creeks.
Spartothamnus teucriiflorus, F. M.
Clerodendrum floribundum, R. Br.

MYOPORINÆ.

Myoporum Cunninghami, Benth.; *Eremophila Mitchelli*. Benth.

MONOCOTYLEDONOUS PLANTS.

LILIACEÆ.

Thysanotus exiliflorus, F. M.; *Corynotheca lateriflora*, F. M.; on sandhills.

COMMELINEÆ.

Commelina ensifolia, R. Br.; under shrubs in shady places.

NAIADEÆ.

Naias major, Allioni.

TYPHACEÆ.

Typha angustifolia, Linné.

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CYPERACEÆ.

Cyperus textilis, Thunb.; *Scirpus littoralis*, Schrad.; in moist ground.

GRAMINEÆ.

Panicum divaricatissimum, R. Br.; *P. Gilesii*, Benth.
P. distachyum, Linné; *P. decompositum*, R. Br.; *P. leucophæum*, Humboldt.
Setaria macrostachya, Kunth; *Spinifex paradoxus*, Benth.
Lappago racemosa, Willd; *Imperata arundinacea*, Cyr.
Andropogon laniger, Desf.; *A. sericeus*, R. Br.
Aristida stipoides, R. Br.; *A. calycina*, R. Br.; *A. ramosa*, R. Br.
Perotis rara, R. Br.
Chloris acicularis, Lindl.; *Eleusine digitata*, Spreng.
E. cruciata, Lam.; *Sporobolus Lindleyi*, Benth.
Phragmites Roxburghi, Kunth.; *Anthistiria ciliata*, L. fil.
Eragrostis Brownii, Kunth.; and *Eriochloa punctata*, Hamilton.

ACOTYLEDONOUS PLANT.

FILICES.

Cheilanthes tenuifolia, Swartz.

The result of my investigations, as far as numbers are concerned, is now as follows:—

	List 1.	List 2.	Total species.
1. Dicotyledoneæ	157	94	251
2. Monocotyledoneæ ...	4	30	34
3. Acotyledoneæ	1	1	2
Total	162	125	287

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Observations about the Habits of some South Australian Ants.

By J. G. Otto Tepper, F.L.S., Corr. Memb.

[Read February 7, 1882.]

[Abridged.]

My own observations refer principally to the forming of new nests, though being only made haphazard, they are not entitled to the authoritative weight of Sir J. Lubbock's, yet they may probably furnish hints to others to clear up the question.

The first incident to be related as bearing on this point occurred when I was still a youth. While walking along the edge of a lagoon, where the water had thrown up small pieces of dead timber, bark, &c., which I turned up in the search for insects, I came across a small number of workers of the common brown Formica clinging to the under side of a piece of thick Eucalyptus bark that had evidently floated ashore in this position, being still within the reach of the larger wavelets. They occupied the only moderately dry spot, and had no female or eggs with them. Without intending any particular experiment, but meaning simply to give the castaways a chance of escape, I took the piece of bark up and placed it on the driest spot near. Such pieces of bark being capital traps for various species of Coleoptera it was visited consecutively at irregular periods, while the ants were regularly noticed. For some time they were content with the habitation with which chance had furnished them ; but gradually getting bolder and venturing more frequently forth for food, they found that they had no near neighbours, which indeed was the case, as an exceptionally high flood had destroyed all ants' nests for some distance the year before.

After some weeks, though, the beginning of the sinking of a shaft was noticed, and at some later visit all the ants had removed to their underground suite, of the growing dimensions of which the increasing height of the characteristic wall of pellets ejected from the shaft, and surrounding it, gave evidence. This shaft had been formed near the edge of the piece of bark so as to afford them shelter from sun and rain until perfectly established. For it must be mentioned that

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these Formicæ (popularly termed the "sugar ants") only move about on cool, cloudy days and dry nights, when they sally forth forage hunting.

This nest was observed for years, and the ants seemed to increase, for on one occasion the *swarming* was observed, but I cannot remember especially noting whether *both* sexes were represented, and my observation is, therefore, somewhat inconclusive.

Sir J. Lubbock cites another observer who had succeeded in establishing a colony artificially, and mentions that he only succeeded in one or two instances out of many by introducing the strange queens at first only to a very few ants, and very gradually increasing their number. It may have been, therefore, in the above case that the small number of ants was an important factor in establishing the colony, inasmuch that they captured one or two stray queens, and elected to be their subjects instead of destroying them.

The "swarming" of ants takes place on warm sultry days, in the afternoons and early part of the evening, not frequently before the summer and autumn, and generally before rain. In the morning preceding it the ants are unusually active, the numbers crowding about the holes increasing as the day advances, till at last the winged males and females begin to appear, at first a few, but in a few minutes pouring out, mixed with the workers in a continual stream. Ascending stalks of grass, &c., all who can take to the air, forming occasionally clouds of insects, and occasionally rising to great heights, exceeding that of very tall Eucalypts, where they only can be distinguished collectively by means of the reflected sun rays, like a faint mist. While flying thus, mates meet, and copulation takes place, the pairs dropping helplessly to the ground, settle on one's clothes, or are carried along by the breeze and snapped up by the swallows. As soon as the act is completed, they cast their wings, and, if near a friendly nest, seek its shelter, to which they are conducted (sometimes assisted by dragging) by the active workers rushing excitedly about in myriads. Or, if not near, they seek some shelter under stones, bark, &c., or in hollows of the ground, where one often meets solitary ones, weakened by starvation, scarcely able to move. Strange to say, it seems that those who do not pair retain their wings for a lengthened period, as I have found solitary ones days after the swarming still with their wings and have kept some, captured at once, in boxes, and forgotten to be killed for the collection, that were afterwards found dead with the wings still firmly fixed, while pairs caught dropped them mostly immediately

On one occasion I came across a nest of the giant Myrmicidæ,

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the black "Bulldog Ant." This was a rather formidable affair, owing to many hundreds of the large creatures (the females above an inch in length while alive) flitting about one's head, all armed with a sting about a quarter of an inch in length, while the shrubs near the nest were covered with scores of pairs and single ones. This took place on April 7, 1880, between ten and eleven o'clock a.m., and I learned here for the first time that the males differ so much in form from the more formidable and aggressive sex that till then they had been looked upon as belonging to a genus of wasps.

They are only from half to two-thirds the size of the females; are much more slender in build, and much more active; their heads are small in proportion, no larger, in fact, than those of certain species of wasps; have weak mandibles (the females and workers possessing very strong ones); and the first joints of the antennæ differ in no wise from the remainder; while the females and workers generally have a very long one at the base, thus producing the appearance of a break or knee-like bend. Though owning a sting, yet this is not long, and they do not employ it very readily.

Reverting to the forming of new colonies of ants, this can be observed easily with two species of ants very common and numerous in many parts of South Australia, viz., the purplish city-building Formica (about a quarter inch in length), and the small black ant (scarcely one-eighth inch), overrunning in countless numbers all dry localities, even cottages, especially where there are trees or shrubs and the grass not dense. Both act essentially in the same manner, but the habits and habitations of the larger species being more conspicuous, I select it for illustration. These ants belong apparently to the Formicidæ, but possess nevertheless a not quite despicable sting in addition to strong mandibles and a very excitable temper.

As localities for their habitations they prefer hard, dry, barren spots, in which they sink their circular and mostly perpendicular shafts, a number of which being situated in close proximity, the distance between them being from three to fifteen inches, varying according to the strength and age of the nest. The ejected grains of gravel and pellets of clay, &c., are placed on the waste ground around and between the holes, get solidified by alternate wetting and drying, and gradually attain very respectable dimensions. One of the largest seen measured about a yard in perpendicular height, and some two or three across, the heap being chiefly composed of ferruginous pebbles from a pin's head and upwards in size, and containing more than a score of shafts. Generally, though, they are only a few inches high in the centre, and where not protected by surrounding shrubs no materials collect, the wind removing

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them as fast as deposited. Yet this does not at all incommode the little worker, or interfere with the increase of population, for I have seen colonies up to ten yards in length and one or two wide on barren roads and even garden walks, prospering exceedingly. Their time of greatest activity in the hot season is the morning and evening, each community having its own district, to the more distant parts of which regular beaten tracks lead, real roads very well defined near the towns, being between one and two inches wide, and trodden out by their own tiny feet, and by their motion kept clear of grass and other obstacles. At varying distances these "roads" become less and less marked by giving off ramifications to trees and shrubs, and finally disappear altogether. Near human habitation their bold, prying, and aggressive habits are apt to become disagreeable, and it was an experience of this kind that led me to notice how nests were formed *de novo*.

Some 50 or 60 yards from my residence, on an old track, was one of these towns. Between it and the former the children used to play, and frequently to consume their luncheon, when, of course, the scattered fragments were left behind. There the ants discovered them and carried them off to their stronghold. After a short time, the sinking of a shaft was commenced at the very spot, which happened to be within some ten yards from the house, and this was quickly succeeded by others, a new colony being thus established. Between it and the parent-nest a continual connection was kept up by a continuous double stream of ants travelling in the one beaten track. On this track again, solitary holes occurred, like hotels on a main road. From the new centre the ants extended their excursions even into the cottage, and, at last, commenced mining operations in front of the door, when I had to interfere in earnest to prevent it. The above facts point to the conclusion that in the selection of a new locality for a nest the ants are guided by the proximity of a copious supply of food as one of the determining causes.

Those ants who are somewhat lazy, &c., construct at first a temporary home, saving themselves from a hurried run should a shower of rain threaten, &c. At the time of swarming, no doubt some of the fertilised females find their way into it, lay their eggs, and thus convert the temporary into a fixed place of abode. If we consider that in the course of the long years these nests remain in existence the localities of the most copious sources of food must change by the decay and growth of shrubs, trees, &c., it is easily seen that the establishment of new settlements will occur in various directions, but without breaking their connection for a long time, thus forming districts over which the ants are all friendly, and find shelter in

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each other's homes. This also will prevent too close interbreeding, the females of all parts of such a district being scattered *ad libitum*, but eagerly preserved by the workers, as being possessed of the same "scent," while those bred from nests originating from a different centre, or the connection of which had been severed by some cause or other for a very considerable period, are destroyed, as Sir J. Lubbock's experiments prove.

When the interests of two hostile districts (*i.e.*, such without previous connection) interfere with each other war ensues, and is kept up for days and nights, if dry weather prevails, with an outrageous determination and cruelty. Thousands of ants may then be seen in groups of two, three, or more, trying which can disable the other first, the dead bodies, with the crippled ones who have lost more limbs than necessary to move with, lining both sides of the track along which the slaughter proceeds. The latter appears only to cease with the utter exhaustion of one of the parties or a heavy continuous rain. Battles like the one described seem to take place but rarely, as I have but three or four times met with them during many years' observation of insects.

The small "Black Ants" do not form "cities," but each nest has only one, rarely two, entrances, surrounded by a conical dyke of ejected pellets, or are quite unprotected. They avail themselves of hollow spaces under stones and in walls—even those under bark or in rotten wood are not despised. But they likewise have roads or tracks, along which they pass through the grass, and in the course of which occasionally new shafts are sunk, thus exhibiting the same manner of operations as the larger species.

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DESCRIPTIONS OF SOME RARE NEW SOUTH AUSTRALIAN LEPIDOPTERA.

By J. G. O. Tepper, F.L.S., Corr. Memb.

[Read April 4, 1882.]

Smerinthus (?) Wayii, *spec. nov.*

This rather large moth was captured in the evening of February 15th, 1882. Being attracted by the light of the lamp, it entered my room, making its presence known by the very loud surring noise of its darting, erratic flight, peculiar to *Sphingidæ*.

Examining it closely one finds that it unites affinities belonging to widely different families—thus, the form of its body conical, smooth, and ending in a point; the small head and eyes; large, hairy, and jointed palpi; and the moderately-long spiral tongue; also the general form of the anterior wings, together with its habit of flight, relate it to genus *Smerinthus*, of the *Sphingidæ;* while the long thin antennæ (though in other respects like those of *Smerinthus*), and the great width (and length) of the posterior wings place it in relation to the family of *Oecneria*, some of which, like *O. monacha*, likewise show the peculiar form of the abdomen. Finally, the coloration of this moth is that common to *Geometridæ*, from which it differs in most other points, notable the very heavy body.

Only one specimen has as yet been seen, thus nothing is known about its habits or transformation.

Considering, under the circumstances stated, that this moth is new, I beg leave to name it after His Honor the Chief Justice, and distinguished President of the Royal Society of South Australia, who so assiduously promotes and patronises science in our province.

Description.—Head small, same colour as body, &c. Eyes not large, blackish, with silvery lustre. Antennæ thin, pointed, about half the length of body; silvery white; fringe bristles minute, greyish-ochre. Wings strong, proportionally wide; when at rest extended, but obliquely elevated; colour light ochreous-brown, irregularly sprinkled with minute blackish dots; a straight, narrow brown bar extends from near the extremity of anterior wings diagonally to near the middle of interior margin, thence extending across the posterior wings to the middle of their interior margin; another, less distinct, curved band, concave towards base, crosses anterior wings

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half-way between base and the long bar measured along middle of wing. A small silvery white lunar spot with black edge is situated between the two bars and crossed by the fourth rib; a similar one, but smaller still, and close to the bar, occurs between the third and fourth rib on the posterior wing. The underside of both pairs of wings is similarly coloured, but paler, with the lunar spots, but without the bars; the ribs are but faintly visible, and of lighter tint than the rest. The anterior margin of first pair is strong and very straight, the extremity forming a sharp projection where joining the outer margin, which is distinctly scolloped, but scarcely fringed; the interior margin is subconvex, the basal part thickly fringed. The anterior margin of posterior pair is convex, and somewhat longer than the inner, which is straight; the outer margin is rounded and lightly scolloped; the wings extend nearly to end of abdomen.

The body is of the same colour as the wings; the thorax is covered above with long hair; the abdomen is conical, quite smooth, the scales being very small and adherent, and terminating in an attenuated point. The legs are weak, bare, smooth; colour a light silvery ochreous tint, covered with numerous minute, black dots; femurs of fore legs almost cylindrical; those of middle pair with two, and the hind legs with four spurs. Only one specimen seen.

	Inches.
Length of body	$1\frac{1}{8}$
Span of wings	$2\frac{7}{8}$
Diameter of thorax	$\frac{1}{4}$

Lithosia rubratra, *spec. nov.*

This is one of the few gaudy-coloured moths of South Australia, which are so rare here. Three specimens—one male and two females—were captured; the first in a wooded gully near Cherry Gardens on November 9th, 1881, late in the afternoon; the others a few days later near the Almanda Mine, Scott's Creek. Its flight is weak and slow, more a fluttering, and of short duration; when resting (which they do on dead branches, especially on such as have been blackened by fire, or covered with lichens) they fold the wings, like some Tineadæ, but do not roll them. Not being aware of any previous description, I beg to attach to it the name *Lithosia rubratra* (the red and black Lithosia) provisionally, as its general appearance agrees best with that genus.

Description.—Rather small; colour bright red or crimson and black. The basal half of both pairs of wings, as well as a narrow band and fringe along their outer margins, is bright red or crimson; also the head, collar and the last segment of the abdomen; the remainder is black, this tint forming a broad

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bar across the distal end of the wings. The under side is similarly coloured, but somewhat paler, the posterior ones showing some yellowish streaks amongst the red. The posterior part of thorax and the two first abdominal segments (much wider than the others) are brownish. The legs are unequal in length, the first pair being only about half as long as the last; the middle pair being intermediate. The two first pairs of legs are wholly black; the former of the last is dark red, and the foot-joints tinged with the same. Spurs are absent from the front legs; the median pair has one, and the hind legs have two near the middle and one at the end of the femur. Claws are very minute or absent. Antennæ two-thirds of length of body; sealed on upper and inner margin of the eyes; compressed; the basal joint large, sub-globular; other joints minute, numerous; furnished with short setæ. The female is a little larger and brighter coloured than the male. Length of body three-eighths to half inch; span of wing, $1\frac{3}{16}$ to $1\frac{5}{16}$ inch.

Thryphæna (?) tineæformis, *spec. nov.*

This day-flying moth is, in the whole, not so rare as the foregoing Lepidoptera, it being found in moderate numbers in the Tertiary scrubs, and coming sometimes in the early parts of sultry evening into the room, being attracted, like many others, to the light. The above provisional name has been adopted to denote that, though the very marked coloration, &c., is that distinctive of the genus *Thryphæna* (Family Agrotidae) yet the slender legs and long palpi establish relationship with the *Tineadæ*.

Description.—Colour brown, orange, and black. Body rather slender, somewhat compressed conical. Anterior wings rather narrow, triangular; colour brown; a broad whitish indistinct bar near its extremity; a larger and a smaller black spot on first rib near middle, reproduced on the under side; the latter light yellow, except frontal margin, tip and outer margin, which are light blackish brown, with a narrow light band along the latter. Posterior wings orange yellow; a broad black band from upper angle to last rib; but one underside light yellow; band reproduced but fainter; fringe narrow, light yellowish. Body light brown above, silvery white below; legs white, very long and thin; forelegs with one pair of spurs; middle and hind legs with two very unequal pairs; one spur of each being very long, the other minute. Head projecting, neck long; these and the thorax dark brown; eyes large, projecting, black; antennæ long, slender; palpi long, slender, brown. The female is a little larger and brighter-coloured than the male.

Length of body—$\frac{1}{2}$in. to $\frac{5}{8}$in. Span of wings—$1\frac{1}{4}$ to $1\frac{3}{8}$ in.

Locality—Clarendon.

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Notes on some South Australian Lizards.

By J. G. Otto Tepper, F.L.S., Corr. Memb.

[Read May 2, 1882.]

In the course of the last week of December, 1881, two rare and remarkable lizards were handed to me by Mr. Bilney, Kangarilla, who caught them in the Tertiary scrub adjoining that township.

Turning to Gray's "Lizards of Australia," 1867, it is easy to see that one is a very near relation to *Hinulia Gerrardi*, from Rockhampton, Queensland; but neither the coloring nor the proportion of the various parts of the figure agree with the specimen. The transverse bands are much more dissimilar, some from the one side not meeting those from the other at all in the middle of the back, while there are short but very distinct rudiments of bars between the principal ones, which are scarcely indicated in Gray's figure by adventitious light markings.

Then, again, the figure of *H. Gerrardi* shows thirteen light transverse bars from the base of the tail to its tip, while the Kangarilla specimen presents only five or six distinct ones and one or two faint ones. Another difference is seen in the much shorter tail in proportion to the body.

When caught from under the rocks it was very lively, and exerted itself much for a day or two to escape, even snapping at the hand, but it soon became quiet, taking raw and cooked meat freely from between one's fingers. The example is unique.

Another species of the genus *Hinulia Greyii* in Gray's work (plate 10), which is recorded by him from Swan River, has lately been noticed by me living, seemingly in pairs, under rocks, close to the river Onkaparinga. My specimens appear to be somewhat larger than the one figured by Gray, but in other respects there seems to be no difference.

The third species is one of the snake-like lizards, which are considered and treated by most people as snakes. It is a *Pygopus*, the genus being easily distinguished by the large plates of the head and the flapper-like rudiments of the hind legs at the base of the tail, and was taken from a small hole in sand by the same person who captured, in the same locality, the large *Hinulia*.

The specimen differs very much in detail from *Pygopus*

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squamiceps, as figured by Gray (plate 8, fig. 3). The first frontal plate, which is whole in the figure, is divided in two in my specimen. The body of the latter is much wider than the head, increasing gradually in width till within a short distance from the base of the tail. The tail is somewhat abruptly joined to the body, and is almost as long as it. The body of *Pygopus squamiceps* is scarcely half as long as that of my example, but is thicker in proportion. The only markings are some minute black dots along the sides of the body, while my specimen presents five conspicuous black marks on the posterior part of the head. The largest one is on the middle line of the body, oblong, with an anterior stalk-like projection; on each side, but farther forward, is a smaller but similar spot, the "stalk" pointing to the upper angle of the eye; in a line with them are two others, but bar-like, one on each side, commencing opposite the hindmost extremity of the central spot and extending diagonally backwards and upwards. The length of the central spot and these bars is about one-fourth of an inch; that of anterior ones one-eigthth of an inch. I cannot discern any dark spots along the sides of the body, but they are distinctly visible from the base to near the tip of the tail at irregular distances, and bordered with white on the lower side. The last inch or so of the tail is covered with very much smaller scales, which are of a yellowish-grey tint, and are marked with short longitudinal lines. The tip of the tail is very thin for about three-sixteenths of an inch, and not hard. The general color is a clear ashy grey above and light grey, tinged with pink, below.

Should this specimen prove to be new, the name *Pygopus longicaudatus* might be suggested as appropriate.

Several examples of *Pygopus squamiceps* have been brought to me that were captured under rocks on the hillsides about Ardrossan, Yorke's Peninsula.

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List of Diurnal Lepidoptera about Balhannah, Co. Adelaide,

with descriptions of new or little-known species.

By E. Guest, Local Correspondent.

[Read May 2, 1882.]

Considering the acknowledged paucity of South Australian Papilionidæ, this locality must be reckoned a fairly good one for this family, as I have collected fifteen species in three years. These and two species known to exist, but not in my cabinet, make a total of seventeen species for this very limited area of about three miles radius. A species of Synemon occurs, but I do not consider it a butterfly.

1.—Pieris Aganippe.

This is not very common, especially the male. I believe it is generally considered double-brooded, but in this locality at any rate I am almost sure this is not the case. The eggs are lain in the spring, and the imago emerges early in autumn, which is the only time when I have ever seen the male. The female passes the winter in some secure spot, and is seen commonly in early spring, but they pair in the autumn, and the male seldom or never survives.

2.—Terias smilax.

Common some years in October; entirely absent in others. It is sometimes—but I think abnormally—double-brooded, as I have more than once seen single specimens in March.

3.—Pyrameis itea.

Not uncommon most years in October, but I am uncertain whether there is one brood or two. It flies in the autumn, and some at least of the females pass the winter in hollow trees, &c., where I have found them in August.

4.—Pyrameis cardui.

Very abundant. The same remarks apply to this species as to *P. itea*.

5.—Juno velleda.

Very abundant. Flies all the year round except in depth of winter, when it hides away like the two preceding insects. I

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think, however, there is no doubt of there being two broods of this species per annum.

6. { Lasiomata atlanta.
   { Xenica Klugii.

This insect is very common, but here, at any rate, there is certainly only one brood, and I have never seen a single specimen in the autumn. The two sexes are almost exactly alike.

7. { Lasiomata merope.
   { Heteronympha meropê.

The sexes vary so much as to appear at first sight to belong to entirely distinct species. It is as common as *L. atlanta*. The males appear about ten days before the females, and are almost exactly like *P. atlanta*, though nearly double the size.

8.—Lasiomata ocrea, *spec. nov.*

This insect appears to be undescribed, and is so named in allusion to a very peculiar marking, like a Hessian boot, on the underside of the wing. It is very rare; I have taken only one specimen, which is, I believe, a female, but Dr. Gaze had, however, previously captured two specimens.

The following is a short description:—

Expanse of wing, two inches. General colour of all the wings, yellowish cinnamon. The apical half of the fore-wing is crossed obliquely by four interrupted black bars, in the centre of each of which is a round black spot with a white eye. The hind wing has a dull round black spot on the costa, and a white one near the centre of the wing, surrounded by a very narrow black line. The underside of the fore-wings is a reproduction of the upper side. The ground colour of the hind wings is nearly white, and there are two jet-black spots with white centres; there are also several dull, blackish-brown smears, and about the centre the large and curious boot-like mark mentioned above. The antennæ are rather short and excessively fine. Body very short.

I now come to the Lycænidæ, of which I have six species included in the genera *Lycæna* and *Cupido*. Unfortunately, however, the descriptions in Mr. Tepper's paper, Trans. Roy. Soc., S.A., Vol. iv., are so short (where, in fact, they are described at all), and the plates illustrating only the top side of the wing, that I cannot with certainty identify all my species.

9.—Cupido Bœtica.

It is very common, flies very fast, and is double-brooded. But is it correctly named?

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10.—C. agricola.

This insect I believe I have also, but it is not common here.

11.—C. adamapuncta.

This is another insect that I think I can recognise, but Mr. Tepper appears to have only the female. The male is exactly the same size, but of a beautiful rich plum colour.

I once found both sexes of this swarming in extraordinary numbers round the white flowers of a shrub called here the box tree. This was in January; but I have on two or three occasions taken the female sitting half asleep on grass-stems in May. It evidently hybernates, and is seen in a tattered state in October.

The other species of this family in my collection I cannot at all identify from either the plates or diagnoses of Mr. Tepper. I have, I think, two species of Lycæna, and one of Cupido, that do not agree with any of his.

12.—Cupido molybdena, *spec. nov.*

It bears a distant resemblance to *C. fasciola*, Tepper, but the markings do not agree, and the male, though smaller, is much *lighter* coloured than the female; the superior surface of the wings of the female being of a very dark burnt amber brown, with a white fringe interrupted with dark brown spots. The under sides of the wings agree pretty fairly with those of *C. fasciola*.

13.—Lycæna pervulgatus, *spec. nov.*

Strange to say, this is the very commonest insect we have. There are at least *three* broods of it, and it may be taken all the year round, even in the depth of winter if the sun should shine out warm for two or three days together. It approaches nearest to *Cupido delicatus*, Tepper, but there is no sign of the appendage or black spot in either sex, otherwise in size and colour it agrees pretty well. I possess also what I suppose to be a dwarf summer brood of this, for I can see no specific difference, that is only three-fourths of an inch across the wing.

14.—L. paradoxa, *spec. nov.*

This is a very singular insect, but unfortunately very rare; size, 1¼ inch. Both sexes nearly alike. Colour, rich bronze, shot with plum colour; this last rather more *prenoncée* in the male. There are no spots or markings of any kind, excepting that the wing rays are yellowish brown. Fringe, bluish white. Underneath, the entire surface of both wings is shiny white, with the least possible tinge of blue, without markings of any kind, excepting a row of very minute jet black specks along and close to the outer margin of both wings. Body and thorax coloured both above and below, the same as the wings.

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15.—Hesperilla fumosa, *spec. nov.*

It approaches nearest to *H. gracilis*, Tepper, but can be distinguished at a glance at the underside, the lower wing having a broad, chalky, white band across the centre, with one white spot above it and no other markings. It is not uncommon; is double brooded, and appears to be particularly fond of the flowers of the *stinkwort*, almost the only insect I know of that is.

16.—Synemon læta.

This is pretty common most years, but local. Its short rapid flight and mode of settling with its hind wings hidden by the top ones, put me in mind of a *Noctua* rather than a butterfly, in spite of the clubbed antennæ.

On the Propagation of Cymodocea Antarctica.

By Prof. P. Ascherson, Berlin.

Translated and communicated by J. G. O. Tepper, F.L.S., Corr. Memb.

[Read June 13, 1882.]

When residing at Ardrossan, on the eastern coast of Yorke's Peninsula, Baron F. von Mueller, K.C.M.G., &c., the illustrious Government Botanist of Victoria, requested me to pay special attention to the above plant in order to obtain flowering and fruiting specimens. This was done accordingly, as far as my other duties permitted, and the observations made were recorded in two short papers published in Vol. IV. of the Transactions of this Society. The separate prints were subsequently forwarded with a number of specimens to Dr. P. Ascherson, Professor of Botany in the Berlin University, who did me the honour to reply by a lengthy letter, expounding his views in the matter under consideration. As this is of general interest in regard to botany, I beg to place a translation of this communication before the Royal Society, as far as relating to the subject. It will be seen that, though my observed facts were correct, the explanation (through insufficiency of the means of critical examination) was not so. (J. G. O. T.)

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"Berlin, April 3, 1882.

"Dear Sir—For your interesting remittances of the 4th February last, I render you my sincerest thanks in the name of the Botanical Society and in my own.

"Your two papers upon the habits of the Cymodocea antarctica have interested me in a high degree; the riddle, which has occupied me for half a generation (more accurately, since 1867), is in its main points solved by your admirable observations.

"As far as I could, I critically examined the material kindly sent me by you. I find your statements of the facts and the illustrations of the same confirmed.

"I cannot, however, entirely agree with your explanation of the same. According to my opinion the whole process is to be looked upon as 'vegetative rejuvenescency.' This expression of the late eminent morphologist and biologist, A. Braun, my ever-memorable teacher, suits in this case most fitly the nature of it. The sexual organs you have not observed, and just this prolific rejuvenesce is qualified to explain their excessive rarity. The 'male organs' are most likely animal inhabitants of the plant, which may probably be specifically determinable. Also in the 'fruits' I can find nothing of the organs of a pistillate blossom, seeds, &c. The male flower is figured by Gaudichaud, consisting of two stamens, joined together longitudinally, borne upon a long stalk, and enveloped in leafy foliage, the sheathing of which they probably little surmount. Each partition of the stamina is surmounted by separate spikelets.

"The structure of the female flowers appears, by the only specimen submitted to me by Baron F. von Mueller, not to differ much from that of the other species. They also consist of two adjacent free carpels, each surmounted by two long ribbon-like stigmata (or pistils). The fruit of those species of *Cymodocea* that is known in the locality of their own home—viz., *C. nodosa*, *rotundata*, *isoetifolia*, *manatorum*—is always strongly compressed, and about half-circularly round, furnished with a hard 'bony' shell, which splits along the margin when germinating.

"The development of the processes you have observed, I imagine to take place in about the following manner:—About the present time—therefore in your autumn—an organ is formed at the apex of a leafy branchlet, recognisable at once by its turning in a right angle to the previous position of the leaves. The same, must in consequence of being concealed in the preceding foliage, not be easy to detect, although the lowest leaf of this bud (from which the 'horny cup' originates) may betray itself to the touch. This

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lowest leaf, which also is the first that crosses the preceding ones, is presumably four-celled from the commencement. The arrangements of structure, promiscuously mentioned by you, of the narrower and wider partitions render it somewhat improbable for four, or two, separate organs, while presenting no difficulty if viewed as parts of a single leaf. Your 'remains of seed' is, according to my idea, nothing but the rudiment of the internode preceding the 'germ leaf,' as I shall call the organ; the 'lid of the ovary,' probably but the point of disjointure, by whose death the young plant becomes free. The 'floral scale' is very probably but a first lamina, and perhaps also the succeeding one, which certainly leaves horny remains. How the following ones are circumstanced, which have already dropped off the young plants, cannot be made out from the material submitted; probably they are leaf-like, though smaller than their successors. A similar process occurs in the formation of the fruit of a water plant appertaining to the old world, *Trapa natans*. The fruit of this plant is built up of four calyx cells; along the midrib horny spikes become free through decay of the external coverings, which remind one of the arrow-barbs of savage tribes, and most likely also bring about the anchoring of the fruit in the soft mud.

"In respect of the rooting process, I had formed a similar idea a year ago, agreeing closely with the facts observed by you, as you would see from my letter to Baron F. von Mueller.

. . . . . .

"In the words you were good enough to cite from my former letter an error is to be corrected, which has been doubtlessly produced by my handwriting. You believed, no doubt influenced by your explanation of the process, that I also speak of a *pistil* (German—Stempel; see note), while, in my case I must have written STEM (German—Stengel)."

NOTE BY MR. TEPPER.—The contrary is the case, as I had formed no explanation till I found in the expression stated what I considered a key to the structure, but which now turns out to have been a misapprehension occasioned by the learned professor's handwriting, which is sometimes difficult to read by one not very familiar with it.

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Notes on the Tertiary Strata beneath Adelaide.

By Professor Ralph Tate, Assoc. Lin. Soc., F.G.S., Corr. Memb. Acad. Sc., Phil.; Roy. Soc., Tasm.; Lin. Soc., N.S.W., &c.

Plate I.

[Read June 13, 1882.]

Hitherto the knowledge of the existence of Miocene strata beneath the City of Adelaide was limited to a small exposure of fossiliferous sandstone in the quarry at the rear of the Government Domain and to shallow well-sinkings, which for the most part do not penetrate the uppermost fossiliferous bed just mentioned.

Towards the end of last year the Hydraulic Engineer commenced a boring in the Waterworks Yard at Kent Town with the view simply of putting the machine on its trial, and to afford persons interested in the application of the diamond drill to the search for subterranean water the opportunity of seeing it in action. By request, I periodically visited the work, and reported on the progress of the boring, which was brought to a close after penetration to a depth of 411 feet, 360 feet of which was in Tertiary strata, and the remainder in the underlying fundamental rocks. The extracted cores range from eight and a-half to six inches in diameter. These reveal so interesting and complete a section of the Older Tertiaries that it seems desirable to record the stratigraphical succession in full; but as the boring section does not commence with youngest member of our Marine Miocene, I have incorporated in the section on Plate I. the strata exposed in recent drainage works, and in the quarry section (now concealed) at the rear of the Government Domain, which fill up the hiatus. Indeed, over the site of the bore-hole a considerable thickness of the Older Tertiaries has been denuded, and its place occupied with Pliocene drifts.

The horizontal section, Plate I., represents the grade from King William-road along North-terrace to the Kent Town Waterworks Yard. The western end of the section gives the stratigraphical succession supplied by the drainage works and the quarry; the eastern end, that of the vertical section, determined from an examination of the bore-cores.

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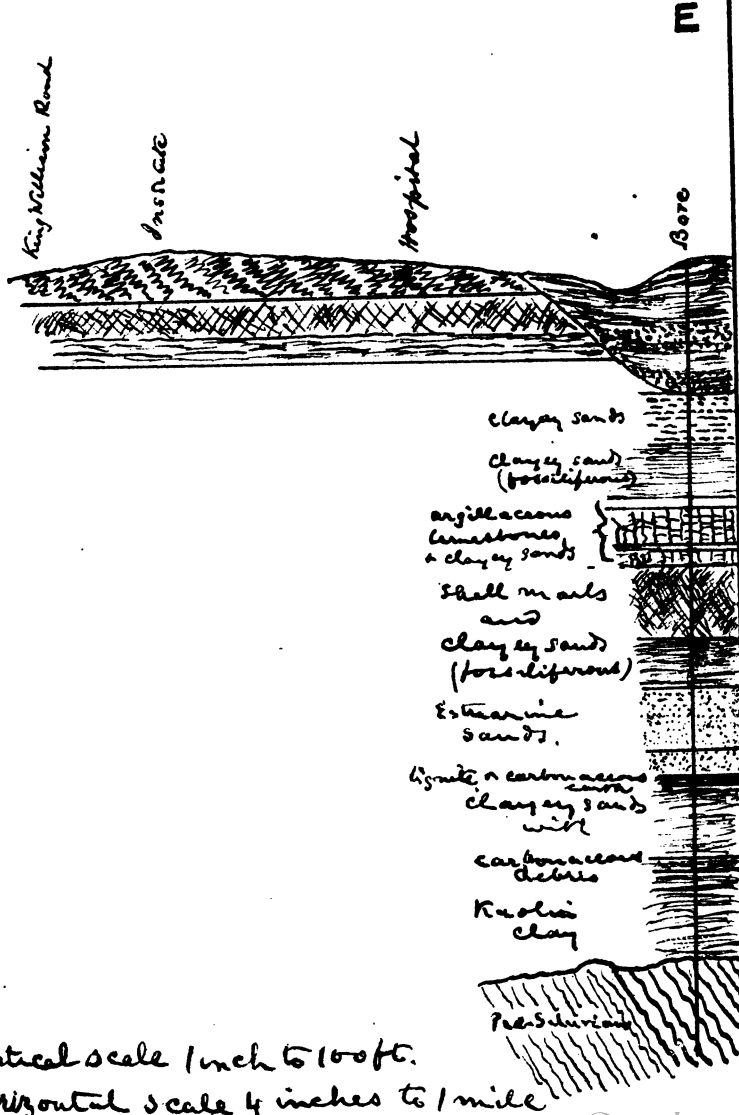
Plate 1.

Section of Tertiary Strata beneath Adelaide



Vertical scale 1 inch to 100 ft.
Horizontal scale 4 inches to 1 mile

R. Tate del.

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The combined section agrees in general features with that of the coast cliffs of Aldinga Bay (for notice of which, see Trans. of this Society, vol. i., p. 121, 1878). The series of the Older Tertiary strata in the Adelaide basin may be summarised as follows:—

A. Estuarine or Lacustrine clay, exceeding 50 feet.
B. Marine—total thickness, 197 feet.
  (*a*) Calciferous sandstones, with oyster banks.
  (*b*) Sandy and calcareous clays, with argillaceous limestones, chiefly in the lower part.
  (*c*) Glauconitic limestones and sands, &c.
C. Lacustrine and Estuarine clays and sands, with carbonaceous debris—total thickness, 142 feet.

Series *a* at the Government-House quarry has yielded very few species of fossils in a state for critical determination, as with the exception of oysters and pectens, their tests have been removed. Nevertheless, these beds are on the same palæontological horizon as similar rocks forming the uppermost fossiliferous strata in the Aldinga and R. Murray Cliffs, which I have elsewhere (Trans. of this Soc., vol. I., p. 121, and vol. II., p. liii., et seq.) named the Upper Aldinga Series and the Upper Murravin Series respectively.

List of Species.

Nautilus sp.: related to *N. pompilius*, but of large proportions.
Cassis textilis, *Tate.*
Haliotis sp.; Bulla sp.
Ostrea cf. edulis, *Linné.*
Pecten spondyloides, *Tate.*
Pecten asperrimus, *Lamarck*, var.
Pecten subbifrons, *Tate.*
Nucula tumida, *Woods.*
Pectunculus McCoyi, *Johnston.*
Cardium.
Placotrochus deltoideus, *Duncan.*

Series *b* corresponds with the Middle Aldinga Beds, which form the main mass of Blanche Point Cliff. As in both, *Turritella Aldingæ* occurs in great profusion.

Not many fossils have yet been extracted from the bore-cores, so that a palæontological analysis of series *b* and *c* is postponed.

The glauconitic limestone which forms the base of the fossiliferous series at Aldinga differs lithologically somewhat from its probable equivalents in the Adelaide section, and the rarity in the latter of echinoderms and palliobranchs is another point of dissimilarity.

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Beneath the glauconitic limestone at Blanche Point, Aldinga Bay, there is an unfossiliferous iron-shot sand of unknown thickness, but which to the north of Blanche Point gradually rises in the section until it attains a level above that of the Upper Aldinga Series, and is seen reposing, at a considerable inclination, against the old slate rocks. It is doubtlessly coeval with lignitiferous clay and sands in the Adelaide Basin.

SECTION OF THE STRATA PENETRATED BY BOREHOLE, KENT TOWN WATERWORKS YARD. Level of Surface—138.83 feet above Low Water Mark.

No.	Description of Strata.	Thickness in Feet.
1.	Soil, &c.	2
	PLIOCENE DRIFT.	
2.	Red clayey loam	28
3.	Fine waterworn gravel	8
4.	Grey pipe-clay, intermixed with sand	2
5.	Subangular gravel, to one-fourth inch gauge ...	5
6.	Grey pipe-clay, intermixed with sand	4
7.	Sharp sand and small gravel	2
8.	Grey pipe-clay intermixed with sand	1
9.	Fine yellow sand, somewhat clayey	3
10.	Grey pipe-clay, intermixed with sand	1
11.	Sharp sand	3
12.	Very sharp white quartz sand, of large dimensions, intermixed with subangular quartzite gravel to 1¼ inch gauge. Water	10
	MIOCENE (Marine).	
13.	Greenish-grey clayey sand and sandy clay ...	11
14.	Grey and reddish mottled clay	14
15.	Fine clayey sand	3
16.	Black clayey sand (fossiliferous)	25
17.	Lighter-coloured and more sandy than No. 16, with thin bands of sharp white quartz sand, which are slightly inclined to the horizontal	5
18.	Light blue calcareous clay, graduating into ...	4
19.	Blue argillaceous limestone (fossiliferous) ...	16
20.	Black, clayey, calcareous sand	3
21.	Black, argillaceous limestone with glauconitic grains. Very fossiliferous	5
22.	Grey shelly marls, with glauconite, varying to compact limestone	30
23.	Sandy and shelly marls	10
24.	Brown and green clayey sands. Very fossiliferous	23

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MIOCENE ? (Estuarine and Lacustrine).

25.	Very fine grey sand	34
26.	Very fine grey sand with carbonaceous *debris*, containing water-worn pebbles and rolled fragments of shell of species occurring in No. 24	12
27.	Lignite mixed with fine mud	2
28.	White pipe-clay with lignite fragments and nests of iron pyrites	14
29.	Brown argillaceous earth mixed with carbonaceous matter and nests of iron pyrites	13
30.	White pipe clay with lignite	9
31.	Fine sand. Water	3
32.	Kaolin clay, mixed with sand in the upper part, and sharp quartz grit in the lower	55

PRE-SILURIAN.

33.	Decomposing felspathic quartzite	11
34.	Decomposed slaty rock, quartz vein	
35.	Decomposed felspathic rock, quartz vein	... 16
36.	Felspathose-quartzite gritstone	24
37.	Thinly bedded fine-grained sandstone with talcose-slate partings	—
		411

SUMMARY.

Recent surface accumulations	2
Pliocene loams, gravels, and clays... ...	67
Marine Miocene	149
Lacustrine Miocene	142
Pre-Silurian	51
Total	411 feet.

Water was tapped in stratum No. 12; it was very salt, and rose to a height of 43 feet in the borehole.

Bed No. 12 I have regarded as the basal member of the Newer Tertiary series, because of its angular gravel, and that the underlying clayey sands, though unfossiliferous, insensibly graduate into others of undoubted Miocene age.

A fair supply water was also obtained in Bed No. 31, it yielded 117.4 grains of solid matter to the gallon. To the taste it was sweetish and slightly saline.

The chief ingredients determined were:—

$CaCO_3$ 5·2, $MgCO_3$ 1.3, NaCl, &c., 110·9.

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Diagnoses of New Species of Miocene Fossils from South Australia.

By Professor R. Tate.

[Read June 13, 1882.]

Pecten subbifrons, *spec. nov.*

An equivalve, somewhat flattish shell, having the general form of the recent *P. bifrons*, and with the same shagreen-like sculpture; but from which it differs in its compressed and truncated ribs. The ribs are about twelve in number, with one or two longitudinal furrows and small tubercles; one or two slender ribs in the flat interstitial spaces.

Locality and Horizon.—In the calciferous sandstones, Adelaide.

Pecten asperrimus, *Lamarck*, var?

A very common pecten in the Upper Aldinga series and its equivalents, I refer with some doubt to the Lamarckian species, *P. asperrimus*, of our waters, which has been subsequently named by Sowerby, and better known as *P. australis*.

The chief differences are printed in italics in the following brief characters:—

Ribs, 24 to 26, flanked on each side by *two* or *three* secondary ribs, *with* or without *one rib in the furrow;* all the ribs with imbricating sub-erect scales or lamellæ. Ears *rather larger* than in recent examples. Largest examples much exceeding recent individuals.

Locality and Horizon.—Upper Aldinga series at Adelaide, Hallett's Cove, and Aldinga; Edithburgh, Yorke's Peninsula.

Pecten spondyloides, *spec. nov.*

Shell equivalve, equilateral, inflated, about as long as broad, covered with numerous compressed spiniferous ribs; the spines are of the nature of compressed imbricating squamæ. There are usually from seven to nine primary ribs, two or three secondaries and a variable number of tertiaries between each pair of primary ribs, all similarly ornamented, the dimensions of the spines varying with the size of the ribs.

Front margin of valves curved or slightly crenulated, not at all angular.

Ears equal, of moderate size, truncated; there is no byssal sinus.

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Dimensions of a largish specimen, length and breadth, three and a-half inches; a large spine of the same, one inch.

Locality and Horizon.—Upper Alding series at Adelaide, Hallett's Cove, and Aldinga.

This very handsome shell has much the appearance of a *Spondylus*, to which genus I had referred it until I succeeded in obtaining a specimen with a perfect umbonal region. The test in the umbonal region is very thin, and often destroyed, otherwise it is fairly thick; and as the matrix is very hard, it is impossible to work out the hinge.

Cassis textilis, *spec. nov.*

Shell ovate, ventricose, whorls seven, varices at successive intervals of about two-thirds of a whorl. Surface ornamented with numerous longitudinal threads crossed by folds of growth. Last whorl bearing on the superior angle a row of (9-10) nodular tubercles, and on the medial portions two others equidistantly placed, the tubercles of which are smaller, much more so are those of the third row. Spire short conic. Columellar callus dentate; outer lip thickened, margin plain; columella very tortuous beneath the callus, canal recurved.

Dimensions.—Total length, 45; breadth, 32; thickness, 29; length of aperture, 31 millimetres.

This fossil bears much resemblance to *C. fimbriatus* of South Australian waters, but differs from it in being more ventricose with a much shorter aperture, in the spiral ornamentation, and in possessing three rows of tubercles.

Locality and Horizon.—The type is from the gastropod-bed beneath the oyster banks of the Upper Murravian, near Morgan, on the River Murray. Casts of much larger size, which may reasonably be referred to *C. textilis*, occur in the Upper Aldinga series at Aldinga, Adelaide, and the Bunda cliffs of the Great Australian Bight; also in the craggy limestones at Mannum, on the River Murray.

Turritella Aldingæ, *spec. nov.*

Shell acutely pyramidal, a little more than three times as long as broad, with three prominent ribs. Whorls about 20 in a length of 35 millimetres, subangular or flattish, separated by a moderately-impressed suture. Base flattened, ornamented with many spiral, unequal-sized threads, which are crossed by very fine radial striæ. Aperture subquadrate, margins united by a thick callus, which extends over much of the base; outer lip deeply and broadly sinuated.

The ornament on the whorls varies much in different specimens as well as in different parts of the same shell.

The medium prominent rib is generally granulose; the posterior rib is bisulcated, or not infrequently replaced by two

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or three strong threads; the interspaces between the ribs and adjacent to the sutures are ornamented with a few spiral threads crossed by curved lines of growth. On the anterior whorls of large examples there are about eight unequal-sized spiral ribs—the posterior rib on the earlier whorls has developed into three prominent ribs, and one or more of the intermediate threads have become conspicuous, whilst the granulations of the medium rib have disappeared.

The posterior six whorls or so have occasionally all the ribs granular, thus resembling *T. Sturtii*, Tenison Woods, of the Tasmanian Miocene; but at this early stage *T. Aldingæ* does not possess intermediate ribs as described for that shell. I am afraid that *T. Sturtii* has been established on too immature specimens ever to allow of satisfactory identification.

Dimensions.—Length, 36; breadth, 10·5 millemetres.

Locality and Horizon.—Argillaceous limestone and associated clays at Blanche Point, Aldinga, and Kent Town bore; also in the "Turritella limestone" about Ardrossan.

Fissurellidæa malleata, *spec. nov.*

The Rev. Tenison Woods referred a Table Cape fossil to the recent *Fissurella concatenata*, and I had given the same name to examples collected by me from the R. Murray Cliffs and at Muddy Creek; but a more critical comparison shows that I have been in error.

The recent and fossil forms agree in shape and in the general character of the sculpture; but in the fossil the pits are of smaller dimensions and more numerous; moreover the foramen is relatively larger and the median contraction is either absent or only feebly shown in the larger specimens.

The fossil species is referred to *Fissurellidæa* because of its affinity with the living South Australian *Fissurella concatenata*, Crosse, Journal de Conch., 1864, which must be transferred to that genus, because the mantle envelopes the shell, as I have ascertained by repeated observation on the living animal.

Dimensions of largest specimen.—Major and minor diameters, 30·0 and 20·0; height, 7·5 millimetres.

Locality and Horizon.—Gastropod bed, River Murray Cliffs, near Morgan, and its equivalent at Muddy Creek in Victoria; Kent Town bore, Adelaide; probably also Table Cape, Tasmania.

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The Land and Freshwater Molluscs of Tropical South Australia.

By Professor Ralph Tate, Assoc. Lin. Soc., F.G.S., &c.

[Read July 5, 1882.]

The land snails of Tropical South Australia are confined to the basin of the northern rivers—to that well-marked natural region which extends from the seaboard to the escarpment of the "Desert Sandstone" plateau, inasmuch as no species has up to the present time been recorded from the extensive tract of country lying north of the MacDonnell Ranges, on the verge of the tropics, to within about one hundred miles of the coast of Arnheim Land.

That the Desert Sandstone, presumably of Miocene age, extended to the seaboard will be readily conceded by those who have studied the physiographic features of the northern part of Arnheim Land; and therefore, the region of the northern rivers, occupied by metamorphic rocks, is as a land-surface of recent date. The area of the "basin of the northern rivers" is rapidly enlarging by the removal of the "desert sandstone," by issue of water at its junction with the schistose rocks, thus originating the numerous affluents of the several large rivers of this well-watered portion of North Australia.

The very large number of immigrant plant species and genera in this region points, likewise, to a more modern origin of its flora as compared with that of the plateau of the Desert Sandstone.

We need not, then, wonder at the paucity of its land snails, whose means of dispersal are so limited, or even at the absence of those genera so characteristic of Tropical Polynesia and N.E. Australia. The climatic phenomena are, moreover, unfavourable to the establishment of species requiring shade and humidity; and the absence of land snails, over the area of the "desert sandstone" and the country to the south with which it is physically and geographically connected, must be attributed to aridity of soil and want of shelter in the form of trees or rocks. Nevertheless, it is not improbable that some species will be discovered in those insular-like masses of old rocks constituting the Ashburton, Forster's, and other Ranges.

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The number of species of land mollusca now known from the region of the northern rivers is eight, distributed generically as follows:—*Helix* six, *Bulimus* one, and *Stenogyra* one. Six of these are either specifically identical or closely allied to extra-limital species. The Helices are considered peculiar to the country, but with the exception of two of them no critical comparisons seem to have been instituted. *H. pomum*, the most widely diffused, is very closely related to *H. pachystyla* of N.E. Queensland; and *H. Meadei* and *H. Lyndii* are also near allies. *H. prunum* has an analogue in *H. argillacea* of Timor, but on the other hand, it is questionably distinct from *H. Coxeni* from Whitsunday Island, off Port Denison, Queensland; and *H. Bennetti* from Ipswich, Queensland, is another critical species of the same group The facts are few, but almost warrant the inference that the Northern Territory Helices are forms of Queensland species modified in the course of their migration. The other land pulmonates are *Bulimus Beddomei*, previously known from Torres Straits, and *Stenogyra Tuckeri*, of Polynesian, if not of American origin, and probably an alien.

The freshwater shells are fairly well represented specifically, and include a greater number of endemic species than might have been expected. Almost every perennial water-course or lagoon has its molluscan denizens. But just as there are two well-marked geographical regions in tropical South Australia, so do we find a corresponding difference in the freshwater shells of the two regions.

The central portion of the continent yields *Unio Stuartii*, *Paludina Waterhousei*, and *P. Kingii*. .

The basin of the Roper, *Unio Angasi;* that of the Adelaide, several *Limnæa*, *Bulinus*, *Planorbis*, *Paludina*, *Unio*, *Corbicula*, and one species of each of *Physopsis*, *Ancylus*, and *Neritina*; that of the Lower Victoria River, *Melaniæ*, a *Paludina*, a *Bulinus*, a *Bithinia*, a *Corbicula*, and a *Mycetopus*, nearly all specifically peculiar.

Several of the species have a wide range throughout the eastern half of the continent, and, with two exceptions, the genera are of world-wide distribution. *Mycetopus* has its head quarters in tropical America, but a species is known from Siam. *Physopsis* includes another species belonging to South Africa. The Australian representatives of these genera are confined within narrow limits. *Mycetopus* in one species is only known from the lower Victoria River, and *Physopsis* from the basin of the Adelaide River and Coburg Peninsula.

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Helix pomum, *Pfeiffer.*

Reference.—*Cox, Monograph Australian Land Shells*, p. 40, t. 4, f. 7, 1868.

Synonym.—H. pseudo-Meadei, *Brazier in Harcus's S. Aust. Handbook* (name only).

This species is peculiar to Arnheim Land, though closely allied to *H. pachystyla*, Pfr., which ranges along the whole of the north-east coast of Australia. It was first obtained by MacGillivray, at Port Essington, and has since been collected in the Port Darwin district. I found it widely, but sparsely distributed over the country from Palmerston southwards to Pine Creek; it was only in the jungles near the coast that it seemed to be at all plentiful.

H. pseudo-Meadei was proposed for individuals of *H. pomum*, which exhibit a stippled ornament on the columella and callus development overspreading the body-wall of the aperture of the shell. As this character belongs to adult shells and there are no co-ordinate peculiarities, the specific name should be suppressed; it is, moreover, inaptly chosen.

Helix Meadei, *Brazier.*

Ref.—*Proc. Zool. Soc.*, p. 662, 1870.

Syn.—H. Edwardsi, *Cox, Mon.*, p. 109, t. 19, f. 3 (non Bland).

Habitat.—Banks of the Liverpool River (Cadell Expedition).

Helix Lyndii, *Angas.*

Ref.—*Proc. Zool. Soc.*, 1872, p. 610, t. 42, f. 1.

Hab.—Port Essington.

Helix prunum, *Ferussac.*

Ref.—*Cox, Mon. Aust. Land Shells*, p. 43, t. 4, f. 6.

Hab.—This species affects the sea coast, and has been collected at Port Essington on the bark of *Melaleuca* by MacGillivray, and at Palmerston by Bednall. I found many examples around Palmerston creeping about in the early morning after rains, but inland it occurred to me in single specimens at Rum Jungle and at the Stapleton River, 26 and 42 miles respectively from Southport.

Remarks.—The periostracum of the young shell is raised into short bristles, and traces of them may be seen in some individuals just prior to attaining their full size. Except in the larger size and deciduous bristles, I fail to note any other difference between this species and *H. Coxeni*, from Queensland.

Helix Creedii, *Cox.*

Ref.—*Mon. Aust. Land Shells*, p. 110, t. 19, f. 2.

Hab.—Cadell's Straits (Cadell Exped., 1867).

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Helix Wesselensis, *Cox.*

Ref.—*Op. cit.*, p. 110, t. 19, f. 4.

Hab.—Wessel Islands (Cadell Exped.).

Helix Gaertneriana, Pfr., recorded in Cox's Monograph as from Port Essington, belongs to the Aru Islands, and is not Australian (*teste* Brazier).

Bulimus Beddomei, *Brazier.*

Ref.—*Proc. Linnean Soc., N.S.W.*, vol. iv., p. 395, 1880.

Hab.—On trees, under the loose bark, Fanny Bay, Port Darwin (Mr. E. Spalding). Also known from Mt. Ernest Id., Torres Straits (*Beddome*).

B. Beddomei is doubtfully distinct from *B. Macleayi* of the same author, which extends to Yule Id., New Guinea.

Stenogyra Tuckeri, *Pfr., sp.*

Ref.—Bulimus Tuckeri, *Pfr.; Cox, Mon. Aust. Land Shells*, p. 69, t. 13, fig. 9.

"Generally distributed throughout Queensland and its islands from Brisbane to Cape York. Found generally in the isles of the S.W. Pacific, and has been introduced to Sydney with plants from Aneiteum."—MacGillivray, in Cox, op. cit., p. 70.

Hab.—At the bases of papaya trees, Palmerston (Inspector Foelsche).

I refer this species to the tropical American genus *Stenogyra*, of Shuttleworth, and on comparison with specimens find it not readily separable from *S. mimosarum*, D'Orb (*Bulimus*).

Genus Limnæa.

The following species and *L. Lessoni*, Deshayes, are usually referred to the genus *Amphipeplea*, but without knowledge of the contained animals. With respect to the generic position of the last-named species, Mr. E. A. Smith, in Proc. Lin. Soc., London, 1882, p. 272, writes:—"It is very doubtful whether this species is a true *Amphipeplea*, upon which subject Martens (Ann. and Mag. Nat. Hist., 1866, vol. xvii., p. 212) offers some very interesting remarks." I am not able to consult the reference alluded to in the foregoing quotation, but having examined the animal of *Amphipeplea Melbournensis*, Pfr., now included among the synonyms of *L. Lessoni*, I can confidently assert that it is a *Limnæa*, and not an *Amphipeplea;* so also is a species inhabiting the Lower Murray River, which is with difficulty separable from the tropical *L. vinosa*. From analogy of shell-form, it may therefore be inferred that the Northern Territory species, which have a very close agreement one with

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another, belong to *Limnæa* rather than to *Amphipeplea*. Personal examination of six species inhabiting the southern part of Australia has elicited the fact that one only, *A. papyracea*, mihi, has the mantle peculiarities of *Amphipeplea* (see Trans. of this Soc., vol. iv., p. 140, and Proc. Lin. Soc., N.S.W., vol. vi., p. 553).

Limnæa Phillipsi, *A. Adams* and *Angas*.

Ref.—*Proc. Zool. Soc.*, 1863, p. 416; *Reeve, Icon. Con.*, t. 6, f. 41, 1872.

Hab.—Arnheim Land (Stuart's Expedition).

Limnæa vinosa, *Adams* and *Angas*.

Ref.—*Proc. Zool. Soc.*, 1863, p. 415; *Reeve, op. cit.*, t. 6, f. 37.

Hab.—Mary River, Arnheim Land (Stuart's Exped.).

Limnæa Angasi, *Sowerby*.

Ref.—*Reeve's Icon. Conch.*, t. 2, f. 11, 1872.

Hab.—Port Darwin.

Genus Bulinus.

The sinistral spiral pond-snails of Australia have been placed (incorrectly so, I believe) in the genus *Physa*. The thick periostracum of most of them, which in many is prolonged into cilia or bristles, is incompatible with a largely-reflexed mantle. I have not examined all the Australian so-called *Physæ*, but in no instance have I found those distinctions which characterise *Physa* as separable from *Bulinus*. The mantle margin is neither expanded nor digitate; in *A. tenuistriata*, however, it has three small serratures on the columella side. Of the Northern Territory species, I have seen alive only *B. concinnus* and *B. Reevei*, which present the characters proper to *Bulinus*. According to Binney, "Freshwater Shells of N. America, 1865," Adanson's name, *Bulinus*, has priority over *Aplexa*, Fleming, and is accompanied by a careful description and excellent figure.

Bulinus Hainesii, *Tryon*.

Ref.—*American Journ. Conch.*, vol. ii, t. 2, f. 9, p. 9, 1866 (Isidora).

Syn.—Physa latilabiata, *Sowerby*, *Reeve's Icon. Conch.*, t. 5, f. 33, 1873.

Hab.—Victoria River.

Bulinus ferrugineus, *Adams* and *Angas*.

Ref.—*Pro. Zool. Soc.*, p. 416, 1863; *Reeve, Icon. Conch.*, t. 4, f. 25 (Physa).

Hab.—Mary River, Arnheim Land (Stuart Exped.).

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Bulinus concinnus, *Adams* and *Angas*.

Ref.—*Pro. Zool. Soc.*, p. 417, 1863 (Physa); *Reeve, Icon. Conch.*, t. 5, f. 35; *Smith, Pro. Lin. Soc.*, vol. 16, p. 281, t. 6, f. 13-14, 1882.

Hab.—Arnheim Land (Stuart Exped.), Pond at "The Gums," twelve miles south from Bridge Creek, Arnheim Land. (R. T.)

Bulinus olivaceus, *Adams* and *Angas*.

Ref.—*Pro. Zool. Soc.*, p. 416, 1863 (Physa); *Reeve, Icon. Conch.*, t. 5, f. 34; *Smith*, loc. cit., p. 281, t. 6, f. 15.

Hab.—Arnheim Land (Stuart Exped.).

Bulinus exaratus, *E. A. Smith*.

Ref.—*Loc. cit.*, p. 292, t. 6, f. 28, 1882 (Physa).

Hab.—Port Essington.

Bulinus badius, *Adams* and *Angas*.

Ref.—*Pro. Zool. Soc.*, p. 416, 1863 (Physa); *Reeve, Icon. Conch.*, t. 7, f. 51.

Hab.—Mary River, Arnheim Land (Stuart Exped.).

Bulinus proteus, *Sowerby*.

Ref.—*Reeve's Icon. Conch.*, t. 6, fig. 43 (Physa).

Hab.—Adelaide River (Brit. Mus.).

Bulinus Bonus Henricus, *Adams* and *Angas*.

Ref.—*Proc. Zool. Soc.*, p. 417, 1863 (Physa); *Reeve, Icon. Conch.*, t. 5, f. 38; *E. A. Smith*, loc. cit., t. 6, f. 29, p. 293.

Hab.—Arnheim Land (Stuart Exped.).

Bulinus Cumingi, *H. Adams*.

Ref.—*Proc. Zool. Soc.*, p. 144, 1861 (Ameria); *Reeve, Icon. Conch.*, t. 6, f. 44 (Physa).

Hab.—Port Essington.

Bulinus Reevei, *Adams* and *Angas*.

Ref.—*Proc. Zool. Soc.*, 1863, p. 417 (Ameria); *Reeve, Icon. Conch.*, t. 6, f. 40 (Physa.)

Hab.—Arnheim Land (Stuart Exped.). Ponds by the River Adelaide, and between Howley and Yam Creeks (R.T.). Also in Yam Creek by Glencoe (J. B. Robinson, coll. Brazier and Bednall).

Physopsis Jukesii, *H. Adams*.

Ref.—*Proc. Zool. Soc.*, 1861, p. 144; *Reeve, Icon. Conch.*, t. 9, f. 71.

Hab.—Port Essington (Jukes, Fly Exped.). Yam Creek by Glencoe (J. B. Robinson, coll. Brazier and Bednall).

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Planorbis Essingtonensis, *E. A. Smith.*

Ref.—*Proc. Lin. Soc.*, vol. xv., p. 294, t. 6, figs. 33-35.

Habitat.—Freshwater lagoons, Point Smith, near Port Essington (*Brit. Mus.*); on submerged plants, River Adelaide (R.T.).

Planorbis meniscoides, *spec. nov.*

Shell shining, pellucid, yellow-horn colour, with a sunken spire, and flattened base; umbilicus deep and narrow. Last whorl obliquely convex above the angulated periphery. Whorls four, convex, separated by a deep suture. Surface marked by strong sigmoidal striæ and folds of growth coincident with the outline of the margin of the aperture, which is very oblique.

This species resembles *Segmentina Victoriæ*, Smith, Proc. Lin. Soc., 1882, p. 296, pl. 7, figs. 11-13, from which it differs by its smaller umbilicus, flatter base, and less convexity of the upper surface.

Greatest diameter, 4·5 millim.; smallest diameter, 4, nearly; height, 1·5.

Hab.—Buffalo Swamp, Port Darwin (coll. Mr. Brazier).

Ancylus australicus, *Tate.*

Ref.—*Trans. Roy. Soc. S. Aust.*, vol. iii., p. 102, t. 4, f. 4, 1880; id. *Smith*, *P.L.S.*, t. 7, figs. 36-37, 1882.

Hab.—River Adelaide; a single specimen, but lost before comparison with type examples (R. T.). The two examples of an *Ancylus* in the British Museum from Comet Creek, Queensland (Leichardt Exped., 1844) seem to be correctly referred to this species.

Melania australis, *Lea.*

Ref.—*Proc. Zool. Soc.*, 1850, p. 185; *Reeve*, *Icon. Con.*, t. 12, f. 82.

Hab.—River Victoria (N. Aust. Exped., 1855); Port Essington (*Brit. Mus.*).

Melania carbonata, *Reeve.*

Ref.—*Icon. Con.*, fig. 88, 1859.

Hab.—Port Essington (Brit. Mus.).

Melania venustula, *Brot.*

Ref.—*Con. Cab.* ed. 2, p. 331, t. 34, fig. 5, 1874; *Smith*, *Proc. Lin. Soc.*, 1882, t. 5, figs. 9-10, p. 260.

Hab.—River Victoria (N. Aust. Exped.).

Melania onca, *A. Adams* and *Angas*,

Ref.—*Proc. Zool. Soc.*, 1863, p. 415; id, *Brot*, *op. cit.*, p. 330, t. 34, f. 7.

Hab.—Mary River, Arnheim Land (Stuart Exped.); River Adelaide (R. T.).

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Melania Elseyi, *E. A. Smith.*

Ref.—*Proc. Linnean Soc.*, 1882, vol. xvi., p. 261, t. 5, f. 12.
Hab.—Australia, probably Victoria R. (N. Aust. Exped.).

Melania Balonnensis, *Conrad.*

Ref.—*American Jour. Conch.*, vol. ii, p. 80, t. 1, f. 10; *Smith, op. cit.*, t. 5, f. 1-3, p. 257.
Hab.—Australia, probably Victoria River (J. R. Elsey).

Paludina Essingtonensis, *Shuttleworth.*

Ref.—*Frauenfeld, Zool-botan. Gess., Wien*, 1862, p. 1,169.
Syn.—Vivipara suprafasciata, *Tyron, Am. Jour. Conch.*, t. 11, f. 71, 1863.
Hab.—Port Essington (MacGillivray); Victoria R. (N. Aust. Exped.).

Paludina australis, *Reeve.*

Ref.—*Icon. Con.*, t. 11, f. 71, 1863.
Syn.—P. ampullaroides, *Hanley in Reeve, Icon. Con.*, f. 30; P. affinis, *Martens, Ann. Mag. Nat. Hist.*, 1865.
Hab.—Port Essington (Capt. Wickham); Victoria R. (N. Aust. Exped.); Depot Creek, ten miles south from R. Adelaide; and lagoons by The Gums, twelve miles south from Bridge Creek, Arnheim Land (R.T.); Yam Creek at Glencoe (Mr. J. B. Robinson, coll. Mr. Bednall).

Paludina tricincta, *E. A. Smith.*

Ref.—*Proc. Linn. Soc.*, 1882, vol. xvi., p. 265, t. 7, f. 16 (Paludina).
Hab.—North Australia [probably Victoria R.] (J. R. Elsey, N. Aust. Exped.).

Paludina dimidiata, *E. A. Smith.*

Ref.—*Loc. cit.*, t. 7, f. 17 (Vivipara).
Hab.—Victoria River (N. Aust. Exped.).

Paludina Waterhousei, *A. Adams* and *Angas.*

Ref.—*Proc. Zool. Soc.*, 1863, p. 414; *Smith, Proc. Lin. Soc.*, 1882, t. 7. f. 14 (Vivipara).
Hab.—Newcastle Waters (Stuart Exped.).

Paludina Kingii, *Adams* and *Angas.*

Ref.—*Proc. Zool. Soc.*, 1863, p. 415; *Smith, P.L.S.*, 1882, t. 7, f. 15 (Vivipara).
Hab.—King's Ponds (Stuart Exped.).

Bithinia Smithii, *Tate.*

Syn.—B. australis, *Smith, Proc. Lin. Soc.*, 1882, p. 267, t. 7, f. 13; non, *Tate* and *Brazier, Proc. Lin. Soc.*, N.S.W., 1881, p. 562.
Hab.—Victoria River (N. Aust. Exped.).

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The genus *Gabbia* was founded on an erroneous interpretation of the characters of a freshwater shell from New South Wales. "Shell like *Amnicola*; operculum, *paucispiral* and calcareous." "The figure of the unique species *G. australis*, Tryon, Am. Journ. Conch., 1865, p. 220, t. 22, f. 7, reminds us of *Bithinia* rather than any other genus, for in it the operculum is represented as decidedly concentric, although said to be paucispiral in the description" (Stimpson, on the Hydrobiinæ, p. 56).

Later, Mr. Brazier described a shell from New South Wales as *Bithinia hyalina*. An examination of typical specimens proves the correctness of the generic position assigned, but a comparison with the figure of *Gabbia australis* leaves no doubt as to the specific identity of the two. The shell has, therefore, been catalogued by Messrs. Tate and Brazier as *Bithinia australis*, Tryon, sp.; consequently a new name must be given to the *B. australis* of Mr. Smith, and I have much pleasure in proposing that of *Smithii*, after its original describer.

Neritina crepidularia, *Lamarck.*

Ref.—*Reeve, Icon. Con.*, t. 8, f. 38.

Hab.—Port Essington (Capt. Wickham and J. B. Jukes).

Corbicula ovalina, *Deshayes.*

Ref.—*Proc. Zool. Soc.*, 1854, p. 343; *Smith, Proc. Lin. Soc.*, 1882, p. 299, t. 7, figs. 24-25.

Hab.—Port Essington. Adelaide River (R.T.), a doubtful identification.

Corbicula Deshayesii, *E. B. Smith.*

Ref.—*Op. cit.*, p. 303, t. 7, figs. 28-29.

Hab.—Victoria River and Port Essington.

Unia Stuartii, *Adams* and *Angas.*

Ref—*Proc. Zool. Soc.*, 1863, p. 417 (Alasmodon); *Reeve, Icon. Con.*, t. 54, f. 279 (Anodon).

Hab.—Newcastle Waters (Stuart Exped.); also in extra-tropical Central Australia.

Remarks.—I do not know why this shell was placed under *Alasmodon*. In all stages of growth all the teeth are developed, all are laminar, elongated, and slightly crenulated on the margin; anterior 2.1, posterior 1.2. A large example from Newcastle Waters has the following dimensions:—Length, 107; breadth, 52; thickness, 30; anterior side, 28; posterior side, 79 millimetres.

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Unio Bednalli, *spec. nov.*

Transversely elongate-oblong, about twice as long as broad; thin, sub-compressed. Epidermis thick, dark brown, radially striated, and concentrically striated between the folds of growth, wrinkled in the flattish postero-dorsal region. Umbones, at about the anterior third, moderately inflated; anterior margin rounded, ventral nearly straight, posterior obliquely truncate. Teeth as in *U. Stuartii*. Interior of valves iridescent bluish, radiately striated. Length, 79; breadth, 40; thickness, 30; anterior side, 23; posterior, 56 millimetres.

Hab.—River Adelaide, at the ford (R.T.); Yam Creek, at Glencoe (Mr. J. B. Robinson, coll. Mr. Bednall).

Remarks.—*U. Bednalli* is related to *U. Stuartii*, from which it differs in being more tumid, less inequilateral, and in its truncated, not acuminate, posterior margin. The epidermis of young shells of *U. Stuartii* is of a pale brown colour, whilst that of *U. Bednalli* is always blackish-brown.

I have much pleasure in naming this form after Mr. W. T. Bednall, to whom science is indebted for bringing to notice many interesting marine species from the Northern Territory and other parts of Australia.

Unio Angasi, *Reeve.*

Ref.—*Icon. Conch.*, t. 55, f. 282, 1867.

Hab.—Strangway's River, tributary of the Roper (Stuart Exped.).

Unio (aff.) Angasi.

Hab.—Ponds by the River Adelaide at the ford and tributaries of the River McKinlay (R.T.).

This form differs from *Angasi* in being more depressed and more arched behind the umbones; the interior is bluish iridescent. Leichardt recorded Unios from the South Alligator River, "smaller than those in the Roper;" these may belong to the same species inhabiting the McKinlay River.

Mycetopus rugatus, *Sowerby.*

Ref.—*Reeve's Icon. Conch.*, t. 17, f. 7; *E. A. Smith* in "Voyage Erebus," t. 4, f. 1.

Hab.—Victoria River (Capt. Wickham).

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PLATE II.

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THE GEOLOGY OF THE NEIGHBOURHOOD OF GAWLER.

By GAVIN SCOULAR, Corr. Memb.

[Read August 1, 1882.]

[Plates II.]

The geological features of the site of the town of Gawler are somewhat diversified and interesting, for no less than four different formations are represented, viz., the fundamental, or "Pre-Silurian Rocks," as displayed on the north bank of the South Para and south bank of the North Para Rivers respectively; Marine Miocenes well exposed in Thorup's Ravine to the east of High-street; Drift, or Pliocene deposits, throughout the Church Hill and old Cemetery area, extending east as far as Blanche-street; Quaternary, in the channels and adjacent to the Para Rivers.

PRE-SILURIAN ROCKS.

The surface configuration of the Pre-Silurian country, which is situated to the east of Gawler Town, is undulating and ridgy on the south-eastern section, whilst on the north-eastern section it is that of isolated conical hills, which for the most part are crowned with reconstructed Miocene detritus, but in a few instances the capping is composed of the original deposit.

Clay Slate.—This rock comprises quite 98 per cent. of the area occupied by the fundamental rocks, and may be studied where outcropping from beneath the Miocenes on the north bank of the South Para (Allotment 327, Hundred Nuriootpa), and on the north side of the town, on the south-east bank of the North Para and bed of Whitlaw Gully, leading through Section 7 of the same hundred. From these points the beds can be traced in ascending order on either side of the Gawler Marine Miocene escarpment, especially on the north bank of the South Para may the various intercalations of the beds be studied with advantage; and in Section 3034, Hundred of Barossa (Cockatoo Creek) a fine section of the slate is exposed in a vertical position. There can be no doubt that in this place we have revealed to us a synclinal axis, which is traceable in a northly direction from the south bank of the South

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Para—Section 1026, Hundred of Para Wirra, to Section 3064, Hundred of Barossa, a distance of four and a half miles.

Though clay-slate is frequently seen at the surface over the south-western portion of Barossa, yet it is only from a few of the outcrops that accurate bearings are obtainable. In Allotment 330, dip 40°, and easterly strike 15° to west of mag. north. The clay-slate here has been used for building purposes, is of the usual argillaceous character, and of medium hardness. In the bed of Spring Gully—Section 5, Hundred of Barossa—a fairly-readable section of the beds is exposed. The dip is 35°, and easterly strike 10° east of north. In Section 3034 the clay-slate is exposed in a vertical position. On the north-western side, in Section 7, Hundred of Nuriootpa, dip 45° easterly, strata somewhat talcose, and much crumpled transversely to the line of strike; also associated with siliceous infiltrations. Section 3044 (Whitlaw Gully), dip 30° easterly, beds presenting the ordinary appearance.

Quartzites.—In Barossa, as well as in Munno Para, as shown in my geological sketch of that Hundred (Transactions of the Royal Society of South Australia, vol. iii., page 106), do the more massive intercalations of quartzite determine to a large extent the surface configuration of the area in which they occur.

The gentle and undulating surface of Western Barossa contrasts with the rugged grandeur constituting the almost inaccessible slopes and peaks of north-western Munno Para. Of the many quartzite bands so extensively developed in the latter area only one or two at the most extend into Western Barossa, and that only for a distance of three-quarters of a mile. But the quartzite bands that do occur in Western Barossa are the northern extension of the quartzites of Western Para Wirra that are shown in the horizontal section accompanying the "Geology of Munno Para" (Transactions Royal Society of South Australia, vol. iii., plate 6, figure 2.)

Though probably diminishing slightly in thickness as they extend through Barossa, yet their stratigraphical characteristics, especially those of the lower or western band, become very interesting.

On the south bank of the South Para River, in Section 1702, Hundred of Para Wirra, the first tangible sign of disturbance or folding of the strata is displayed; and on the northern side of the gorge, about 200 feet above the bed of the stream, on the western boundary of Section 110, Hundred of Barossa, the practised eye can discover that the strata have been subjected to a powerful pressure acting transversely to the strike. In Section 1702, Hundred of Para Wirra, the synclinal and anticlinal folding of the strata, as shown in the cross section

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accompanying this paper, becomes first observable, and it is only at intervening places going north to this point that the axis of the syncline is preserved—as only the most depressed parts along the axis of the syncline have escaped denudation. The localities where these phenomena are shown most visibly are laid down on the map.

On the south side, but especially on the northern side of Cockatoo Creek, in Sections 1030 and 3034, a conspicuous section of the synclinal folding is displayed. From the somewhat indistinct manner the quartzites are exposed on the south side of the creek, it is difficult to describe their exact relative position. Here the synclinal axis seems to be confined within the quartzites, and so severely have the upper beds of the band been acted upon by pressure whilst undergoing the process of folding that a casual observance of the beds in that particular place might readily be set down as a re-deposition of the original material. On the northern side of the creek the section is less obscure, and a pretty correct analysis of the position of the beds has been ascertained. Whilst in company with Professor Tate, on the eastern side of the band, in Section 1030, we found the beds well defined, and dipping 80° westerly. Very nearly on the same line of strike, and about five chains north from this point, in Section 3034, we found the dip to be 70° westerly. The strike at both places is 10° west of mag. north. Though no exposure of the quartzites on the western side of the band is here displayed, it is evident from the position the clay-slate assumes a few chains to the west, viz., dipping easterly, that the axis of the syncline, if not actually occurring within the quartzites, must be in close proximity on the western side of the band.

As further proof of the uninterrupted occurrence of this synclinal fold extending for miles along the strike of the beds, the high westerly inclination of the quartzites is well exhibited in two separate quarries in Sections 3035 and 3036. In the southern quarry, in Section 3035, dip 80° west, strike mag. north, and the northern quarry, situated on the southern side of Section 3036, dip 75° west, and the strike also mag. north. Here it is also evident the synclinal axis must either be within the quartzite beds or in very close proximity west of them, for, as at Cockatoo Creek, the westerly dipping side of the fold, by artificial means, is also well exposed. The easterly dipping section, though it cannot be far distant, is obscured by the overlaying detritus.

From this point quartzite is but faintly seen on the higher ground, and it is not until reaching Section 3064 that it again boldly comes to view. Here a quarry (Springbett's) has been opened on it on the southern slope of the east and west

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ridge. The stratigraphical relation of the beds are much easier determined here than in Sections 3034, 3035, or in 3036, and, as shown in my horizontal section, the eastern limb of the syncline of the quartzite band dips 35° westerly, and the strike is 10° west of mag. north. The quartzite folding round the superimposed clay-slate appears on the western side of the reserve, in Section 722. As represented by horizontal section, it will be seen that the anticlinal axis of the band and a considerable portion of the subterimposed clay-slate have been carried away by subsequent denudation, and that the actual dip side of the quartzite band constitutes an integral part of the formation about 20 chains to the east. The stone in this quarry, and also in those situated in Sections 3036, 3035, and 3034, is better adapted for road than architectural purposes.

It is noteworthy that for a distance of over four miles we have indubitable evidence of the occurrence of foldings nearly parallel with the strike of the beds; this by some might be regarded as being only on a small scale, but its presence suggests the probable existence of others of greater magnitude hidden from our observation; therefore a difficulty arises in correctly estimating the actual thickness of partially-concealed strata.

Eastern Quartzite Band.—The eastern quartzite band, as it appears on the south bank of the South Para River, in Section 3281, north-western Para Wirra, makes the prominent landmark locally known as the Boar's Snout. This band, which is here of vast thickness, constitutes the high ground to the west of the deserted auriferous Miocene cement workings of Victoria Hill, passes through mineral Section 426, where it has been invaded transversely by denusive agency to such an extent as to admit of the detritus of the auriferous cements on the eastern side being carried some considerable distance to the west. Passing immediately to the east of "Malcolm's Barossa" Mine, it constitutes the high ground between that mine and the alluvial diggings of Spike Gully; it intersects Cockatoo Creek in Section 782, from thence through Sections 3021, 3022, and 721. In Section 726, where also a quarry of road metal is situated, the dip of the band is 68° easterly, strike 5° west of mag. north, thickness estimated from 60 to 80 feet. It is here of medium hardness, and is composed of fine grains of quartz held together by felspathic paste, which being subject to decay renders the stone somewhat too friable for road purposes.

Fundamental Limestone, or Marble.

The susceptibility of this stone to uniformity of decay and the frequent occurrence of Miocene *debris* spread over its surface throughout the area of Western Barossa make it difficult

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to trace its outcrops for any appreciable distance. There is no doubt, however, that the bands occurring in Sections 3347 and 1032, Hundred of Munno Para, extend north into Sections 1728 and 3095, Hundred of Barossa, while the line of outcrop of the western Para Wirra band can be easily followed in Para Wirra for a distance of nearly three miles, is on entering Barossa only well exposed on the road leading between Sections 107 and 106, becoming entirely obscure in Section 105.

Quartz Veins.

The primary object of the geologist is simply to characterise the stratigraphical relation of the beds upon which he essays to treat. But the district of Barossa being one, in some measure at least, associated with mining enterprise, and the subject of discussion, viz., "quartz veins," being fraught with much interest to the public—especially to those engaged in a mining venture—as to the percentage of their metalliferous contents, for this reason it is with considerable diffidence to suit the various feelings I approach this part of my subject. Also, I trust, the scientist in this particular walk will kindly correct any inadvertency into which the following remarks may tend to lead.

On the north bank of the South Para River, in allotment 337, there occurs a quartz vein of considerable thickness in connection with numerous leaders, or rather subsequent infiltrations, of quartz throughout the adjoining clay-slate; the dip and strike of the vein itself is apparently in conformity with the lay of the surrounding beds. A vein of quartz in Section 479, Hundred of Barossa, is of considerable thickness, but is barren of metalliferous properties. Another which extends south into Munno Para is exposed in uniformity with the dip and strike of the slate rocks in the precipitous bank of the river in Section 3095. The apparent strike of this vein leads me to conclude it to be the southern continuation of the vein exposed on the southern side of Spring Gully in Section 482. Here the vein-stuff is composed of barren massive white quartz, and over twenty feet in thickness, which on the northern side of the ravine is entirely hid from view by the overlying Miocene beds. On the south side of the gully, in the same section, to the west of this reef a heterogenous interlamination of slate and quartz peeps out, and is traceable for a considerable distance conformable with the general strike of the beds. This phenomenon, has, however, evidently no direct connection with any well-defined system of quartz veins, but is merely one of those nest-and-string-like occurrences so frequently found displayed throughout the slate rocks of the neighbourhood.

North-east of Gawler, in the bed and south bank of

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Whitlaw Gully, Section 7, Hundred of Nuriootpa, a deserted drive, situated on the southern side of the gully, has been extended into a similar heterogenous mass, a distance of from 20 to 30 feet. This adit penetrates the strata at an angle of about 45° south-east to the line of strike. Though of little or no mineralogic value, it is, nevertheless, interesting to the geologist in so far as it exposes a rock section which otherwise would have been concealed.

On the western side of the eastern quartzite band laid down on the map, and embraced in the sketch, a quartz vein, which has several quartz leaders, intersects Sections 424, 425, and 426, and is well known to extend into Section 834. Here the leaders, or quartz interlaminations, have been proved in the Malcolm's Barossa Mine to contain copper and gold; but up to date neither of the metals has been found in payable quantities.

I may here remark that none of the Barossa quartz veins has proved metalliferous in a high degree, and it is a noteworthy fact that the quartzite band passing immediately to the east of this mine and extending north and south many miles throughout northern Para Wirra and southern Barossa at least is the line of demarcation between the more highly metamorphosed rocks on the eastern side and the less altered rocks on the western side of the band. If accessive metamorphism be at all conducive to the concentration of metallic deposits, then, as metallic deposits are only sparingly distributed in the reefs on the eastern side of the band where metamorphic agency has been most potent, they will be still more sparingly distributed on the western side where metamorphism has evidently been much less active.

Miocene.

Superficial Area.—The *debris* derived from this formation constitutes most of the soils and subsoils immediately to the east of Gawler and throughout the higher tracts in Concordia District, and in the same detached condition it stretches south-easterly into upper Cockatoo Creek. Also the gravelly gold-bearing cements of Yatta Creek, Victoria Hill, and neighbourhood, and on towards Williamstown belong to the same geological epoch. Indubitable evidence still exists to show that this formation, in a fragmentary state, extends to a height of at least 1,000 feet above sea level, and that that portion of Barossa Hundred, comprising the Barossa goldfields, Cockatoo Creek, Lyndoch Valley, Concordia, and immediately to the east of Gawler, was at one time uninterruptedly overlain with Miocene strata. In the immediate neighbourhood of Gawler its vertical thickness must have been something very consider-

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able, for the portion still remaining east of Murray-street—Thorup's Ravine—still represents a thickness which cannot be far short of 80 feet. A section of the beds in this gully, and adjoining slope south of the horizontal sectional line, is as follows :—

Strata unseen, occupying the southern slope between actual summit of the quarry, and where the cross sectional line traverses the strata. Additional depth	16	feet
Gravels	4	"
Gravels, sometimes conglomerates	8	"
Micaceous sandstone	12	"
Sandstone, fossiliferous	18	"
Unseen immediately opposite the quarry, but lower portion shown elsewhere in bed of the ravine, much thinner bedded sandstone	12	"
Total from top of quarry to bed of ravine ...	54	"

From the escarpment at Gawler these Miocene beds extend uninterruptedly inland to the east for a distance of about three and three-quarter miles, and they are also exposed in many isolated patches throughout western Barossa, but do not, however, afford any good sections. As a rule, the beds are composed of fine sand and a gravel chiefly of quartz pebbles. The pebbles, though generally small, are present in various forms—from the rhomb, as if newly torn from the parent rock, to that of the highly waterworn and globular. The ferro-arenaceous and pebbly character of the beds, and the high slope of the surface of the old rocks on which they rest, indicate that the portion now remaining is merely the littoral deposit of the formation. Under such circumstances it is not to be wondered that the organic forms are few and ill preserved. Sir Charles Lyell, in his "Elements of Geology," sixth edition, page 445, where he treats of the "Origin of New Red Sandstone and Rock-salt," says :—"It is a general fact, and one not yet accounted for, that scarcely any fossil remains are preserved in stratified rocks in which this oxide of iron abounds ; and where we find fossils in the New or Old Red Sandstone in England, it is in the grey and usually calcareous beds that they occur."

This oxide of iron is the constituent the Gawler and Barossa beds abound in ; but whether its presence has any bearing upon the non-fossiliferous condition of the Gawler and Upland Miocenes is a subject well worth further consideration. The sparsely fossiliferous beds at Gawler extend without a break to the east, and attain an elevation of about 420 feet above sea

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level, and outliers of this formation are distributed at much higher altitudes over the adjoining country. These outliers differ very much in stratigraphical character; some are highly ferruginous, whilst others are chiefly composed of small quartz pebbles cemented together by a ferruginous paste; others again consist of fine sand particles impregnated with ferruginous matter. The best section of one of these outliers is that exposed in a cutting on the road leading between Sections 3035 and 3059. The excavation is from 4 to 5 feet, comprising bedded sand rock 3 feet 6 inches under a cover of earthy sand and surface deposits 1 foot 6 inches. The plane of bedding, as nearly as could be ascertained, is horizontal.

The following is a vertical section of the Gawler Reservoir, which has recently been excavated to a depth of 12 feet in the Miocene beds, situated in Section 3073, Hundred of Barossa, and at an elevation of 389 feet above sea level :—

	FT.	IN.
Dark-coloured soil	0	6
Subsoil, marly clay	1	6
Stiff chocolate coloured clay, supposed to be Miocene ...	6	0
Soft unfossiliferous sand rock, ferruginous	4	0
Total	12	0

Fossil Remains collected from the Gawler beds at Thorup's Ravine, and determined by Professor Tate, are as follows :— Clathurella, sp. ; Teredo, sp. ; Cardium, sp., aff. acuticostatum ; Trigonia semiundulata, McCoy ; Leda Marthæ (?), McCoy.

In Thorup's Ravine, and throughout the area of Gawler East, especially at Mars Hill, many fine specimens of silicified wood have been discovered, both *in situ* and in the *debris*. Though chiefly found in a fragmentary state, yet the freshly woody-fractured appearance many of the specimens present leads to the conclusion that the site of their growth was not far distant. Also on the south-south-east side of Cockatoo Valley the leaves of a tree evidently belonging to some of the existing Australian species have lately been discovered in a highly ferruginised sandstone of Miocene age. This interesting specimen is exhibited in the Gawler Museum. In treating of the silicified wood of Gawler, Professor Tate, in his annual address to the Philosophical Society of South Australia for 1878-9, page 59, says :—"Again, the scarped ridge east of the main street of Gawler is made up of coarse sand, crowned by rounded gravel. The sands contain blocks of stone, resulting from consolidation of the sands by carbonate of lime, which yield a few marine fossils, and also silicified stems, having a structure resembling that of *Casuarina* and *Eucalyptus*." The Professor adds :—"The process of silicification took place sub-

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sequent to entombment in the marine or estuarine beds, because the stems are not infrequently found to be drilled by Teredos." Such a commingling as witnessed at Gawler, of portions of comparatively stately land plants with marine forms undoubtedly reminds us that a much greater annual rainfall took place in Australia during probably the close of the Miocene period than what we at present witness.

In concluding this sketch of the Miocene, I might instance three notable sites where highly waterworn conglomerates of Miocene age are found resting immediately upon the upturned edges of the old rocks, viz., in a small gully leading into Whitlaw Gully on the south side, and south bank of the North Para River, both of which are situated in Section 12, Hundred of Nuriootpa. Also on the eastern side of Section 479, at an elevation of not less than 400 feet, a ferruginous conglomerate of the same age and kind occurs. All these sections are well exposed, and exhibit strong proof that they at some distant period constituted portions of a Miocene shore-line.

Drift, or Pliocene.

Area.—On account of the bold character of the pre-existing surface immediately to the east of Murray-street, very little of the formation has been preserved *in situ* east of the Miocene escarpment. So far as the lower or western part of the town is concerned, the deposits embracing the site of that part have in a marked degree been laid down against a Miocene cliff, which prior to the period of the Drift must have presented a high and bold outline to the eastward, where Murray-street is now situated. In defining the boundary of the main sheet of this formation as developed at Gawler, I might here say a small patch of it occurs on the north bank of the South Para River, in allotments 327 and 328, and continues to extend north along High-street, embracing the site of the Old Cemetery, Church Hill area, &c., Gawler North, and several other small detached areas throughout the tract embraced in the sketch.

Thickness.—The vertical depth of this formation about Gawler must vary with the increasing distance as we recede from its outcrop. Tracing it from east to west, the thickness of the formation at Gawler cannot be compared with what it attains in parts of the eastern seaboard of St. Vincent's Gulf; as, for an instance, the bore-hole at Port Wakefield shows the depth of the Drift to be there 292 feet below present sea level, and the main mass of the formation on Gawler plains attain an altitude of 450 feet above the present sea-line; therefore we have pretty conclusive evidence that a continuous depression or sinking of Gulf St. Vincent and neighbourhood

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took place during the deposition of the Drift to the extent of something closely approaching 800 feet. By directing attention to this fact, I do not mean to infer that the formation ever attained a thickness of 800 feet in any part of the neighbourhood referred to, but that a steady oscillation of land and water to that extent over the area has taken place so recently, geologically speaking. This view harmonises in a marked degree with Dr. Croll's cosmical theory of the glacial epoch of the northern hemisphere, and was applied by me as originative of the Australian Drift period (see Transactions of the Adelaide Philosophical Society, 1878-9, pages 65 and 66).

Quaternary.

This formation embraces a considerable portion of Murray-street, the lower portion of the site of the town, the greater portion of the Park Lands, and also detached areas, as exhibited in Spring Gully, Cockatoo Creek, Whitlaw Gully, and North and South Para River.

Soils and Subsoils.

Alluvial.—The site of the greatest part of this description of soil about Gawler precludes its fullest utilization for garden or other productive purposes.

Drift.—Soils derived direct from this formation are chiefly confined within the limit of the site of the town, therefore they are also of little or no agricultural or horticultural value.

Miocene.—The soils of Gawler, which have been chiefly derived from the waste of the underlying Miocene rocks, present a kindly character and greater adaptability to the growth of the native pine and kindred species, shrubs, &c., than either the soils of the Drift proper, or those immediately derived from the fundamental rocks. To the north-east of this tract, throughout the sub-division of Western Barossa, known as the Concordia District, the surface outlines of the country are undulating, and the soils and subsoils of a mixed character; the hill-tops being covered with soils—including many quartz pebbles—which have evidently been derived from the waste of pre-existing Miocene beds, whilst the adjoining flats—the beds of which, since Miocene times, have been denuded below the horizon of the fundamental rocks—are now covered with soils and subsoils derived from both formations. On my examination of this part of the district I was impressed with the idea that the soils and subsoils of the flats were outliers of the true Drift; but on further consideration, after having revisited the locality, I have satisfied myself that they are chiefly of a sub-aerial wash from the adjoining slopes.

Fundamental Rocks.—On the south of the Gawler Miocenes,

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and extending to the quartzite band passing between Sections 111 and 726, on the east, the soils and subsoils—with a few exceptions, where outliers of the Miocene beds occur—have been derived from the decay of the underlying fundamental rocks. Where the substratum is clay-slate, and the soil and subsoil of moderate depth to the bed rock, these, though at first less fertile than those derived from the Miocenes, are much more enduring.

Water, Surface and Subterranean.

Surface.—Surface water at Gawler during the summer months is obtained chiefly from the North Para. Though a plentiful supply pours down the channel of the South Para in winter, the stream, on reaching the drift formation, ceases to flow during the months of summer. In Cockatoo Creek a moderate supply is sustained at all seasons of the year; and Mr. John Martin informs me that Spring Gully, though at no season of the year a large stream, continues to trickle through the pebbles in its bed during the dry months of summer. In connection with these creeks, I might here remark that the drainage area of both is, in a great measure, overlain with Miocene beds. As to the hydrological properties of the Upland Miocene, I refer to Transactions of the Royal Society of South Australia, vol. iii., page 110. None of the minor gullies throughout the tract embraced in sketch sustains surface water all the year round.

Water-bearing Properties of the Drift at Gawler compared with those of Munno Para, East of Smithfield.—The Government well at Gawler, is undoubtedly situated in the drift area, and according to Parliamentary paper, 5th July, 1881, a section of the strata penetrated is as follows:—

Surface portion of the shaft, chiefly gravel and sand, with some bands of clay intervening. Water struck

Thirty-five feet from the surface, sand and boulders	35 feet.
Shaft sunk a further depth of 17 feet	17 "
Tubes were driven down a further depth of 40 feet into sand and gravel	40 "
Total depth of perforation	92 "

The base of these interbedded clays, sands, and gravels which I refer to the Drift, is only 75 feet above the present sea level. That they are water-bearing here, and not elsewhere in Munno Para (see Transactions of the Philosophical Society of South Australia for 1878-9, page 63), can only be attributed to the excess of inflow over the outflow. That this excessive inflow is not due to subterranean permeation direct from the older rocks is pretty evident, because no

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water is found in the Miocene of the immediate neighbourhood, and in Section 3076, Hundred of Barossa, where water is found in the fundamental rocks, the waterline is considerably higher than that in the Gawler drift sands. Taking into consideration the limited depth of clayey deposits overlying the drift sands in the beds of the North and South Para Rivers, it is therefore evident that the water supply obtained in the Government and private wells throughout Gawler is chiefly derived from infiltration of river waters as they pass over the thin superficial stratum of pervious deposit at or near the junction of the Drift with the old rocks. In support of this opinion I have to state that the South Para ceases to flow for five months in twelve over the Drift within a few yards of the Government well, which is only 35 feet in depth from the surface to the water-line; and as the bed of the river is 15 feet below the level of the mouth of the well, consequently the river bed is but 20 feet above the water-line in the well. The stream, thus situated, and flowing—especially during high flood—a distance of not less than 15 chains over so pervious a material, as shown by the strata exposed in the well, must penetrate and surcharge the underlying sands and gravels to the fullest extent. Whilst considering this seemingly unlimited water supply, we must not overlook the fact that the beds in which it is stored, at an elevation of 132 feet above sea level, constitute an integral part of a formation extending far below the present shore line; it is, therefore, perfectly evident that a barrier of impervious material, sufficient to oppose the further downflow of the water absorbed by the Gawler sandbeds, exists at no great distance to the west, otherwise these beds would, like their prototypes east of Smithfield and in Section 3205, Munno Para, be non-productive of water, showing also that the well from which the Gawler Waterworks is supplied merely taps this subterranean lake, and derives its supply chiefly from the flood-waters of the South Para. It, therefore, becomes a critical point to consider whether its contents during the dry season—especially a prolonged one—will be sufficient to meet the requirements for which the works were originally executed.

Previous to the Government undertaking, the Drift yielded, for all purposes, a moderate supply of subterranean water from wells throughout the town and suburbs. The supply of these being derived from the same source, it is highly probable that the Government well will partially drain those during summer droughts, and the inhabitants and factories, especially the latter, will become dependent upon the waterworks for a supply during those periods.

Miocene.—About Gawler and Western Barossa, as in Munno Para, the Miocene beds, though good rain collectors and of

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highly absorbent properties, constitute no actual subterranean lodgment within the area named. Nevertheless, the beds still remaining to the east and north-east of the town aid in an indirect way most powerfully the production of the water supply found in the subaerial Drifts of the low-lying tracts throughout the Concordia district, as also the water supply to wells in the fundamental rocks. And, as already noticed, the surface drainage of Spring Gully and Cockatoo Creek is traceable to the same indirect source.

Fundamental Rocks.—On the southern side of Section 3076 passable fair water was struck in the clay slate at a depth of 95 feet from the surface. A section of the strata penetrated is as follows:—

Surface and subsoil	12	feet
Limestone rubble (?)	45	"
(From a description given of the nature of this rubble by Mr. T. Barrett, digger, and owner of the well, I am inclined to set this 45 feet of so-called limestone rubble down as being Miocene.)		
Clay slate	50	"
Total	107	"

Also in Section 3077 a good supply of very passable water was found in the slate rock in Whitlaw Gully at a depth of not more than 15 feet below the bed of the ravine.

Economics.

Gold.—Though the precious metal was known to be sparingly distributed throughout the sands and gravels in the bed of the South Para River as early as 1851, it was not until its discovery in the Pliocene alluvial deposits of Spike Gully in 1868 that much attention was directed to its presence in these regions. Soon after this the auriferous Miocene cements of Victoria Hill attracted special notice, and though they could be considered neither highly productive nor of great superficial area, yet ardent hopes were entertained that better results would be obtained at greater depths in the neighbouring quartz reefs; hence a desire arose to test the auriferous properties of the quartz veins.

The most probably auriferous quartz veins of Barossa are chiefly confined to the eastern, or Spike Gully side of the quartzite series laid down in the map accompanying this geological sketch. As to the probability of gold or other metals being diffused throughout the quartz veins situated on the western side of that quartzite band, I will offer a few remarks. About eight years ago a mine was started—since known as "Malcolm's Barossa"—on the reef or reefs situated in Mineral

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Section 424. Subsequently a shaft was sunk on the property to a depth of 200 feet, a steam engine and other necessary appliances were erected, five trial or test drives in that depth were made in various directions to ascertain the metalliferous character of the quartz veins intersecting the property—as officially reported—in which both gold and copper were obtained, and yet the mine, for the time being, was abandoned because it did not pay working expenses. At date, working operations are again in full activity, and with what result at greater depths time will reveal. But my opinion as to the gold-bearing character of the property is adverse to its becoming more auriferous at greater depths than it has proven to be nearer the surface—(1) Because the partially-auriferous quartz veins of Barossa are associated with rocks which belong to an age anterior to that in which highly and regularly auriferised veins are known to exist in any part of the world; (2) Apart from the age of the rocks, no similarity exist between the condition of the Barossa beds and those of the neighbouring colonies with which auriferous veins are associated. The Silurian rocks of the neighbouring colonies have been subjected to plutonic outbursts of granites and felstones, unknown among the fundamental rocks of Barossa; and in more recent times, especially in Victoria, where the quartz veins traversing the Silurian rocks have been found to be most highly impregnated with gold, it is near to where volcanic agency has been most potent during middle and more recent Tertiary times (see Anniversary Address by Professor Tate to the Royal Society of South Australia, for 1880-81, page 119). Therefore I conclude that, although some of the Barossa quartz reefs are found sparingly auriferous in patches at or near the surface, according to the foregoing argument, it is no warrant of the precious metal becoming more generally and exuberantly diffused throughout the veins at greater depth.

Copper.—Ores of this metal have been found sparingly diffused in various parts throughout the district. It is at "Malcolm's Barossa" that the metal has been found in greatest abundance, but as in the case of the precious metal, at a depth of 200 feet it has not been found in paying quantities; it is questionable also whether larger cupriferous deposits remain to be found at greater depths.

Petroleum.—Several futile efforts have recently been made to obtain this liquid mineral within the district of Barossa. As opinions differ so vastly as to the nature and condition of oil-bearing strata, I am induced to cite here a portion of the article in connection with the above heading, as it appears in the late Dr. Page's "Handbook of Geological Terms":—"It occurs in

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various formations, chiefly in connection with fields of coal and lignites, and appears to arise from the decomposition or distillation of these strata by subterranean heat." According to the above, and the treatises of other authors upon the origin of petroleum, it is merely the outcome of entombed animal and vegetable decay under certain chemical conditions. If ever such forms were enclosed in our fundamental rocks these conditions, or more strictly speaking, metamorphic actions, have long since carried the necessary constituents far beyond the point of ordinary liquefaction. Therefore it would be, under the present state of information, a criminal weakness to offer an inducement that the sought-for treasure is sure to be found in these beds (see Professor Tate's Annual Address to the Royal Society of South Australia, 1880-81, pages 124 and 125).

Building Material.

Quartzite.—This material is moderately plentiful in Western Barossa. North of Cockatoo Creek, in Sections 3034 and 3036, abundance of quartzite of medium architectural quality could be obtained; also a very fair building quartzite—though seemingly only fit for rubble work—can be got at Springbett's Quarry, Section 3064.

Marble.—It is not at all improbable that a marble of very fair architectural properties may be procured in Sections 105 and 106.

Clay-Slate.—Though a considerable quantity of clay-slate of late years has been used in Gawler for building purposes, very little of that material comes from Barossa.

Brick-Clay.—Ordinary brick of very fair quality has been and is still being manufactured, as occasion requires, from the drift-clays on the flats of the North and South Para Rivers.

Sand.—Sand of excellent quality for building purposes is obtained from the bed of the rivers; and for the use of the iron and brass founder it is procured of very fair quality from the more friable arenaceous beds of the Miocene deposits immediately to the east of High-street, and the sandy loams on the banks of the rivers.

Mortar.—The travertines of Barossa are very much inferior to those of Mudla Wirra for building purposes; therefore the mortar used in Gawler and neighbourhood is chiefly procured from the adjoining Hundred.

Road Metal.—A considerable part of the road metal used in Gawler is of pebbles from the rivers; travertine is also used to some extent, and is chiefly obtained from the adjoining Hundreds of Munno Para and Mudla Wirra. In Western Barossa a very fair quartzite metal is obtained from Springbett's Quarry, Section 3064; likewise from a band situated in

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Section 726, and also from Sections 3035 and 3036. An excellent metal is also obtained in various parts from the highly-ferruginised conglomerates and compact arenaceous beds of the Miocene.

Conclusion.—Geologically speaking, Gawler and Western Barossa, though moderately provided with some of the necessaries calculated to advance people in the general commercial pursuits of life, are not likely ever to attain great mineral prosperity. The soils, formerly of medium fertility, have already yielded their virgin treasures to continuous culture; and the mineral wealth—never proven to be great—has been steadily decreasing since the auriferous drifts of the South Para and Spike Gully were discovered—the former in 1851 and the latter in 1868. Seeing that both these sources of wealth have passed the zenith of productiveness, especially in an agricultural and horticultural sense, at which the greatest possible return can be obtained for the least possible outlay, it now becomes a serious matter to consider can artificial means be applied to replenish in a day, or a year, the treasure which cost nature thousands—possibly millions—of years to provide.

Notes Relating to the Geology between the Burra and Farina.

By Gavin Scoular, Corr. Memb.

[Read August 1, 1882.]

Farina.—A private well, about half a mile north-west from the railway station, had been sunk at the time of my visit, June 18, 1882, to a depth of 81 feet. The section is as follows:—Drift overlying Secondary—probably Jurassic—gypsiferous beds, in which salt water was struck at 35 feet; similar gypsum-bearing strata for a further depth of 32 feet; then a band of fundamental quartzite was encountered, from which no water flows, and penetrated to a depth of fourteen feet. The opinion held by local authorities is that an abundant supply of fresh water will be obtained when the quartzite band is pierced; and all that is needed is to puddle back the inflow of salt water derived from the Drift and gypsiferous strata. The creek, in which the so-called "Government Gums" and "well" are situated, has evidently been excavated out of the Secondary limestone, as throughout the neighbourhood the escarpments consist of it. These limestone elevations do not generally exceed 30 feet in height, and are composed—at the surface at

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least—of hard and compact rock; but the lower tracts are composed of gypsum beds, and may be studied in the railway cuttings. The secondary rocks thin away, and leave the fundamental strata entirely exposed at about ten miles south from Farina.

Redhill.—At this Railway Station a large reservoir has been excavated in a very stiff and consolidated clay, probably derived from decay of the fundamental rocks *in situ*.

Leigh's Creek.—For a short distance north, and near this Railway Station, the rocks appear to dip at an inclination of about 65° north-easterly. North of Beltana the dip is south-easterly, and a short way south of the Railway Station the dip, which has greatly decreased, is again north-easterly. Here the beds exhibit a dusky purple colour and flagstone structure; indeed, so much so does the stone seem to partake of the latter quality that I am persuaded excellent flagging is procurable from them. Marble of no mean quality outcrops over the surface of the little rise between the Railway Station and the township, and abounds in the neighbourhood. The Railway Station has been chiefly constructed of a blue marble, and although some few of the blocks in the building might be considered by experts to be somewhat argillaceous, the bulk is exceedingly pure, and capable of retaining a very fine polish.

Black Rock Plain and Terowie.—Bounded at no great distance on either side by the Black Rock Range on the east and the Pekina Range on the west, as a natural consequence the drifts constituting the whole of the Black Rock Plain may pretty safely be looked upon as being water-bearing at no great depth from the surface. In the township of Terowie, west of the railway, Mr. Harrison, the miller, informed me that he obtained a plentiful supply of water in the Drift, immediately overlying a ferruginous cement, at the depth of a little over 60 feet. The water is passably potable, and was used last summer by many of the neighbours to a large extent; in short, its having been in use for steam purposes for a period of over three months, without chipping and cleaning the boiler, is pretty sure indications of its potable qualities. On the eastern side of the railway, and about one-quarter of a mile distant from the site of Mr. Harrison's well, the railway reservoir has exposed in the Drift a similar bed of ferruginous conglomerate about three feet in thickness at about 12 feet below the surface of the plain.

Yarcowie.—About two miles west of Yarcowie Railway Station, on the property of Mr. Alexander Mitchell, the slate rocks dip at an inclination of about 70° westerly, the strike being from 16° to 20° east of mag. north. Interlaced with these slaty beds a prominent reef of very hard crystallized

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quartz traverses the country for a considerable distance, in several parts of which the proprietor has discovered cupriferous indications.

Water seems to be readily enough obtained for sinking in this part of the country. Mr. Mitchell has two excellent wells of water on his estate, one of which is situated about half a mile away on the farm, and the other, which is close by the stables at the homestead, was sunk to a depth of 70 feet through a hard blue slate. The water in this well, from which a never-failing supply is obtained, is also passably potable, and has risen fully twenty feet in the shaft.

Burra.—In a cutting immediately north of the Burra Creek, the rocks dip westerly. On visiting the Burra, about seven years ago, I accurately determined the dip of a marble band and surrounding beds to be easterly. The section is in the bed of a small creek immediately north-west of the deserted smelting works, and situated about three-quarters of a mile to the east of the railway cutting. This reversal of the dip of the beds clearly points to the existence of an anticlinal axis between the two points, and the prevailing dip of the rocks in the neighbourhood being easterly, in all probability a synclinal axis occurs in the beds a short distance west of the Burra railway station.

List of Recent Echini of South Australia.

By Professor R. Tate, A.L.S., F.G.S., &c.

[Read October 3, 1882.]

Goniocidaris tubaria, *Lamarck.*

Very general (*R.T.*), ranging from Port Jackson to Eucla on the frontier of West Australia.

Strongylocentrotus eurythrogrammus, *Valenciennes.*

In shallow water. Port Adelaide, St. Vincent's Gulf, Fowler's Bay (*R.T.*).

Sphærechinus Australiæ, *A. Agassiz.*

Washed ashore on the sandy beaches of the South Australian coast (Tenison Woods, Proc. Lin. Soc., N.S.W., vol. ii.).

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Temnopleurus toruematicus, *Klein.*

Dredged in life from two to three fathoms off Port Vincent, St. Vincent's Gulf (*R.T.*); identified by the Rev. T. Woods. It also occurs, though rarely, at Port Lincoln, and generally on the south and south-west coast (Ten. Woods, *op. cit.*).

Salmacis globator, *Agassiz.*

Kangaroo Island.

Amblypneustes ovum, *Lamarck.*

Very general, and the commonest urchin of our shores (*R.T.*)

Amblypneustes pallidus, *Lamarck.*

South Australia. Possibly only a variety of *A. ovum.*

Holopneustes porosissimus, *Lutken.*

Var.? Test red, poriferous zone equal in width to the median ambulacral space. Great Australian Bight (*R.T.*)

Echinus angulosus, *Agassiz.*

Near and about Port Adelaide and St. Vincent's Gulf (*Ten. Woods*); Port Lincoln (*R.T.*)

Laganum (Peronella) Peronii, *Agassiz.*

Holdfast Bay (rare); Wallaroo (common) (*R.T.*).

Echinarachnius parma, *Lamarck.*

Common at Guichen Bay (*Ten. Woods*).

Echinocardium australe, *Gray.*

Robe and Aldinga Bay (*T. D. Smeaton*).

Brissus sternalis, *Lamarck* (*?*).

An example collected in Aldinga Bay by Mr. T. D. Smeaton, which measures eighteen millimetres in length, may be a young form of this species.

Schizaster ventricosus, *Gray.*

Aldinga Bay (*T. D. Smeaton*).

Linthia australis, *Gray.*

Common at times in South Australia (*Ten. Woods*). Fowler's Bay (*R.T.*)

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On a Winter-Flowering State of Hypoxis pusilla, J. Hooker; and on the differential characters of that species.

By Professor Ralph Tate, Assoc. Lin. Soc., F.G.S., &c.

[Read June 13, 1882.]

Pasture lands on slaty hill-slopes and loamy flats are abundantly adorned in the months of August and September with the bright yellow star-like blossoms of *Hypoxis pusilla*, J. Hook.; but on the 26th of May, while making close search for the florets of the lowly *Lagenophora emphysopus*, J. Hooker, which I detected in numbers on the pasture slopes of the slaty hills near Belair, overlooking the Adelaide Plain, I was attracted by the matured capsule of a minute lily-like plant. Further exploration revealed the fact that the scanty herbage was largely constituted of the filiform leaves of this species, which presents the salient characters of *Hypoxis pusilla;* but not one of the very many plants examined exhibited expanded flowers. In all stages of flowering the perianth segments were closely adpressed to form a green erect column to the ovary. A few days later I examined the North Adelaide Park Lands at spots which I knew to be yellow with the flowers of this species at a more advanced season, with similar results. These early flowering examples are evidently cleistogamous, the floral envelopes never expanding, and their self-fertilising powers is attested by the abundance of seeds in every capsule. Similar phenomena are exhibited by *Salvia verbenaca*, which has become a troublesome weed, far beyond the limits of the city, during the last five years.

The chief botanical characters belonging to this form are as follows:—Subterranean portions of leaves and scapes enclosed in a membranous sheath, the short, bronze, scarious, ovate, acutely pointed lamina of which appears just above ground. The leaves do not exceed three inches, are filiform with revolute margins rather than channelled; in number never less than two, sometimes three or four. Flowering scape usually very short and one-flowered; sometimes the ovary is not raised above the surface of the ground, whilst in others it is lengthened to half an inch. Two setaceous bracts, usually opposite, are situate at about the middle of the scape. As the ovary ripens

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the scape is reflected, and finally by its increased weight is brought to the ground. The outer segments of the perianth are green on the outside and yellow within; the inner alternating ones are yellow, narrower, and shorter than the others. The stamens are six in number—three long and three short—the anthers shortly auricled at the base. The three long stamens are a little shorter than the inner perianth segments, but as long as the style. The stigmatic lobes are three, and papillose; they are closely pressed together by the anthers of the three long stamens, some force being required to overcome the adhesion between the papillose styles and the margins of the open slit of the dehiscing anther cells. The ripe capsule is oblong, subangular, slightly constricted under the perianth, and rugged by pressure of the closely-packed seeds within; it is about four lines long and two in diameter, and dehisces circumcissally at a little below the base of the persistent perianth. The seeds, which are in two rows in each cell, are black, globular, pitted, and are furnished with a prominent hooked hilum.

Except in one main particular these characters are those assigned by Bentham, "Flora Australiensis," vi., p. 450, to *Hypoxis pusilla*, the capsule of which is stated to be globular, and not ovoid or oblong. I have examined a very large number of capsules of the plant species above described, and in only one instance have I noted a globose capsule.

Supplementary Remarks:—Since first observing the winter-flowering individuals of *H. pusilla*, I have carefully watched for their further development, and have concluded that they are succeeded by others approximating in size to *H. glabella*, from which they are distinguishable by sufficiently well-marked though trivial characters.

From July 8 to July 31.—The winter flowers sparingly in number; capsules all burst; no increase in the size of the leaves.

August 12.—Still a few flowering examples of *H. pusilla*, forma *hyemalis*; leaves three to four in number, two and a half inches long, scapes one quarter to half an inch in length. First appearance of expanded flowers, accompanying leaves, four to six in number, and five to seven inches long; scapes three to three and a half inches in length; the flowers correspondingly large. These latter were either from the corms which had previously borne winter flowers, or from those which had already produced leaves at an early period of the year.

August 24.—*H. pusilla*, forma *æstivalis*, in full bloom; in stature varying from the dwarf winter-flowering state to nearly

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equalling that of *H. glabella*. The largest blossoms observed at this date measured 9 lines in diameter, outer perianth segment 4, and inner perianth segment 3.75 lines. (Read October 3.)

The summer plant not unfrequently bears two flowers on separate pedicels in the axil of the bracts, as was surmised might be the case by Bentham.

Now, after a very searching inquiry into the habits and morphology of *Hypoxis glabella* and *H. pusilla*, in the course of which I have examined hundreds of specimens of each, I am constrained to agree with Mr. Bentham, and to differ from my honoured and esteemed friend, Baron Sir F. von Mueller, that they are specifically distinct; though at the same time I must acknowledge that the differential characters derived from the relative inequality in length of the stamens and of their auricles, the length of the perianth segments, and the shape of the capsule prove to be inconstant; but taken collectively, and in conjunction with the very decided differences in the bracts, make it easy to separate the species.

H. glabella is a larger plant, stamens nearly equal in length, long anthers, scapes one-flowered, with a large erect sheathing bract, usually one inch long. It inhabits preferentially rich and moist pastures at comparatively high elevations, and flowers in September and October.

H. pusilla, as represented by the type corresponding to our form *hyemalis*, is a dwarf plant with the stamens alternately long and short; short anthers, and scapes with two setaceous bracts, sometimes two-flowered, especially in our form *æstivalis*, which often exceeds in size dwarfish specimens of *H. glabella*. It affects dry and loamy soils at various altitudes, which are watered by direct rainfall. It flowers from May into the summer months.

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On a New Dilleniaceous Plant

from Arnheim Land, N.A.

By Baron Sir F. von Mueller and Professor Ralph Tate.

[Read July 5, 1882.]

Pachynema sphenandrum, *spec. nov.*

Branchlets somewhat diffuse or erect, numerous, wiry; six inches high; leaves reduced to small semilanceolar pointed scales; flowers solitary, terminating, ultimately elongated, almost stalk-like and somewhat recurved branchlets; sepals oval-roundish, the inner twice or three times as long as the outer; coronula between petals and stamens, membranous, soon deeply torn into several lobes; filaments obovate wedge-shaped, confluent with the very minute anther; ovaries two, each suddenly terminated by a very short subulate style; fruitlets nearly globular, somewhat longer than the calyx.

At the Gorge, near Yam Creek, on granitic debris; *Prof. Tate.* [Phyt. Mus. Melbourne and Herb. Univ. of Adelaide.]

Branchlets thinner than those of *P. junceum*, from which it also differs in habit; scale-like leaves, hardly exceeding a line in length; calyx at the base, almost angular, turgid; inner sepals about two lines long; petals obovate, at the base cuneate, 2 to 3 lines long, probably white when fresh; stamens about eight, completing a cyclus, slightly incurved, turgid, each resembling a minutely biporose anther; coronula fully as high as the stamens; ovaries glabrous; fruitlets when matured about a quarter-inch long. Ripe seed not yet available.

The development of a coronula and the thickening of the stamens upwards render this plant somewhat anomalous in the genus; still, as all other characteristics, and also the general habit, sufficiently accord with *Pachynema*, it will be best to consider this congeneric, but to establish for it a separate section, to which the name *Stemmatanthus* is to be given, and this appellation may serve also should it be deemed better to isolate this plant generically.

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On a New Rhamnaceous Plant from South Australia.

By Baron Sir F. von Mueller and Professor R. Tate.

[Read October 3, 1882.]

Trymalium Wayæ, *spec. nov.*

Rather tall, erect; leaves obovate-spatular, not large, nearly flat, above glabrous, underneath as well as the branchlets very thinly grey-velvety; stipules almost semilanceolar, acuminate; panicles short, with several but not numerous flowers; bracts rather small persistent, nearly ovate-lanceolar; pedicels generally not much longer than the flowers; calyx-tube thinly velvety, much shorter than the lobes, the latter glabrescent outside, petals undivided, dilated upwards, gradually narrowed into the base; style exceedingly short; stigma conspicuously three-cleft; disk glabrous.

In the Gorge of the Onkaparinga, by the river side, about three miles above Noarlunga. *Prof. Tate.*

A lax shrub, attaining a height of eight feet. Leaves usually from one-half to three-fourths of an inch, but attaining to one inch in length; decurrent into a short petiole; their vestiture much appressed, but not silky shining. Diameter of expanded calyx about one-eighth of an inch; segments greenish-yellow inside. Petals longer than the stamens. Filaments about as long as the roundish anthers. Disk much depressed, slightly crenulated. Ovary three-celled. Capsule ovoid, two lines long and one and a half lines in diameter; stellately pubescent, and slightly convex at the top, but little elevated above the adnate calyx-tube, and crowned by the persistent calyx lobes. Cocci firmly membranous, apparently indehiscent, slightly wrinkled on the inner face.

General appearance more like *Pomaderris myrtilloides* and *P. vaccinifolia* than any resemblance to congeners, unless in its broad-leaved form to *Trymalium Wichuræ* and to *T. ledifolium*.

The species is dedicated to His Honor S. J. Way, Chief Justice, and President of the Royal Society of South Australia, through whose active interest for the prosecution of phytographic research the discovery of this and some other additions to the Flora of South Australia is mainly due.

T. Wayæ is apparently rare, as only one group of six bushes is known for a length of several miles in the Gorge of the River Onkaparinga. It was flowering profusely in the first week of November, but does not seem to perfect its fruit, inasmuch as not more than seven or eight capsules rewarded a close search undertaken a month later.

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On a New Acanthaceous Plant

from Arnheim Land, N.A.

[Read September 5, 1882.]

By Baron Sir F. von Mueller, F.R.S., Hon. Member.

Strobilanthes Tatei, *spec. nov.*

All over densely short-downy; leaves on exceedingly short stalks, or almost sessile, rhomboid- or roundish- or lanceolar-ovate, flat, quite entire at the margin, or scantily indented; peduncles bearing one to three flowers; bracteoles minute; calyces about as long as the pedicels, cleft to the middle into ovate, or narrow semi-lanceolar lobes, the two upper somewhat or scarcely smaller; corolla scantily pubescent outside, its lobes all oblong-ovate, in length about equal to the entirely cylindrical tube, the latter bearded inside towards the orifice; stamens four, equally fertile; filaments free from near the summit of the corolla-tube, conspicuously emerging; anthers, blunt; ovary quadrate-roundish, as well as the style glabrous.

At the Twelve Mile, Mackinlay River; *Prof. Tate* (Herb. Univ. of Adelaide).

Leaves two-thirds to one and one-third of an inch long, of conformity in each pair. Peduncles not much longer than the leaves, or shorter, with terminale pedicels. Imbricate bracts, none. Bracteoles exceedingly short and narrow. Calyces about four lines long. Corolla measuring half to three-quarters of an inch in length, colour purple, the narrow tube passing suddenly into the lobes. Anther-cells free up to the middle, scantily hairy. Stigma not much broader than the style, acute and slightly cleft at the upper end. Fruit not obtained.

This species belongs to the aberrant forms of *Strobilanthes*, its connection therewith being formed by *S. tristis* and *S. Walkeri*, so far as the conspicuous development of pedicels is concerned. In habit it comes nearer to some species of *Calophanes*, notably *C. vagans;* indeed, it could be removed to that genus should the spurred anthers of the latter no longer be insisted on as essential characteristics. Again, the paucity of the ovules and the elongation of the pedicels almost solely remove this new plant from *Ruellia*, unless the fruit should yet offer further remarks for discrimination.

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Additions to the Flora of South Australia.

By Professor Ralph Tate, A.L.S., F.G.S., &c.

Introductory Note.—The additions to the list of phanerogamic plants are numerous, the greater part of which results from a revision of the plant species of Australia, and of their geographical distribution undertaken by our illustrious honorary member as a basis for a census of the plants of Australia, now in course of publication; some have already been recorded as varieties in the "Census," and many, through indefiniteness of habitat, had been overlooked. Others forming not an inconsiderable number are recent accessions, and of these no less than thirteen have lately been described as new species by Baron Sir F. von Mueller; they are:—*Phyllanthus Tatei*, *Swainsonia Oliveri*, *Acacia Gilesiana*, *A. Kempeana*, *A. cibaria*, *A. sessiliceps*, *A. estrophiolata*, *Millotia Kempei*, *Helichrysum Tepperi*, *H. Kempei*, *Trymalium Wayæ*, *Dœmia Kempeana*, and *Spartothamus teucriiflorus*.

Some additions to the list of evascular Cryptogams have already been published in the supplement to the 11th volume of the Fragmentorum Phytographiæ Australiæ, but since then other gatherings have been dealt with by the following specialists, and several important discoveries are here now made known for the first time:—Mr. Mitten has determined the mosses; Dr. Cooke, the fungs; the late lamented Dr. Sonder and Dr. J. Agardh, the Swedish veteran algologist, the seaweeds; and Dr. J. Mueller, the lichens.

The total results, excluding a small number of species erroneously introduced in the "Census," are as follows:—

Flowering plants ...	additions,	147,	making a total of	1,727
Vascular Cryptogams	"	2,	"	33
Charas	"	0,	"	7
Mosses	"	7,	"	43
Liverworts	"	0,	"	6
Lichens	"	12,	"	22
Fungi	"	11,	"	97
Algæ	"	28,	"	301
Total additions		207	Total species	2,236

The additions to the geographical divisions are numerous—for Kangaroo Island, eastern part, no less than 125 phanerogams; but I have not thought it advisable to publish them, in

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view of an early issue of a new edition of the "Census," which is necessitated by the large increase in the number of species and considerable change in the species-nomenclature.

The regional divisions adopted tentatively in my "Census" as indicative of the lines of immigration of the constituents of our flora may be subject to modification in accordance with the meteorology and geology now somewhat better known. The geographical demarcation of sub-botanic regions can only be approximate, but for practical purposes a boundary line must be drawn. The characteristics, physical and botanical, of each division have to a large extent been gained by personal exploration, but the botanical details can only be ascertained from local observers working throughout the year. To such I make an earnest appeal for help. Some portions of the colony have not at all, or have been very imperfectly examined, or about them more detailed information is wanting. Such are the western portion of Kangaroo Island, south part of Yorke's Peninsula, south and central parts of Eyre's Peninsula, the country about the Coorong, the country towards the Glenelg River, and generally the Far North and West.

DICOTYLEDONEÆ.

Cruciferæ.

Lepidium rotundum, DeCand.; i., 85. Vicinity of Lake Torrens *(Young)*.

Cakile maritima, Scopoli; F. v. M., Native Plants Vict., p. 40. D'Estrees Bay, Kangaroo Island (*R. Tate*).

Violarieæ.

Hymenanthera Banksii, F. v. M.; i., 104. Gorge of the Onkaparinga River, near Noarlunga (*R. Tate*).

Polygaleæ.

Polygala chinensis, Linné, *sp.*; i., 140. Alice Springs (*E. Giles*).

Comesperma viscidulum, F. v. M., Frag. x., 4. MacDonnell Ranges (*E. Giles*).

Malvaceæ.

Sida rhombifolia, Linné; i., 196. Hermannsburg, R. Finke (*H. Kempe*).

Abutilon cryptopetalum, F. v. M.; 201. Hermannsburg, R. Finke (*H. Kempe*).

Abutilon halophilum, F. v. M.; 206. Near Lake Eyre (*E. Giles*); Peake (*J. C. Chandler*).

Abutilon oxycarpum, F. v. M.; i., 204. Near Lake Eyre (*E. Giles*).

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EUPHORBIACEÆ.

Micranthemum hexandrum, J. Hooker; vi., 57. Square Waterhole, Encounter Bay (*O. Tepper*).

Beyeria viscosa, Miquel; vi., 64. Dry bed of R. Torrens, near base of Mount Lofty Range (*F. v. M.*).

Phyllanthus Tatei, F. v. M.; S. Sc. Record, March, 1882. Bundaleer Range (*R. Tate*); Victor Harbor (*O. Tepper*).

URTICACEÆ.

Urtica incisa, Poiret; vi., 190. Strathalbyn (*F. v. M.*); R. Murray Flats at Mannum; banks of Cygnet River, Kangaroo Island; and around swamps in the South-East (*R Tate*).

SAPINDACEÆ.

Dodonæa lanceolata, F. v. M.; i., 475. Near the Finke River (*H. Kempe*).

ZYGOPHYLLEÆ.

Zygophyllum Howittii, F. v. M.; Frag., iii., 150; xi., 29. Towards Will's Creek.

RUTACEÆ.

Boronia parviflora, Smith; i., 324. Square Waterhole, Encounter Bay (*R. Tate*).

Eriostemon sediflorus, F. v. M ; i., 342. Extending to Lake Torrens (*F. v. M.*); Ardrossan (*O. Tepper*).

PLUMBAGINEÆ.

Plumbago Zeilanica, Linné: iv., 267. On the River Finke (*H. Kempe*).

AMARANTACEÆ.

Ptilotus incanus, Poiret; v., 221. Hermannsburg (*H. Kempe*).

SALSOLACEÆ.

Chenopodium rhadinostachyum, F. v. M.; S. Sc. Record, May, 1882. Near River Finke (*H. Kempe*).

Chenopodium auricomum, Lindley; v., 159. Hermannsburg, R. Finke (*H. Kempe*).

Atriplex campanulatum, Bentham; v., 177. Near Lake Torrens.

Atriplex limbatum, Bentham; v., 178. Near Lake Torrens.

Atriplex crystallinum, J. Hooker; v., 180. Sandy sea-shore near mouth of Glenelg River.

Bassia lanicuspis, F. v. M.; v., 195 (Sclerolœna). Near Lake Torrens.

Kochia sedifolia, F. v. M.; v., 187. Murray Scrub (*F. v. M.*), Bunda plateau (*R. Tate*), Fowler's Bay (*Mrs. Richards*).

Salicornia leiostachya, Bentham; v., 203. Near the Finke River (*H. Kempe*), Lake Eyre (*Lewis*), and Lower Barcoo (*Howitt*).

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LEGUMINOSÆ.

Lotus corniculatus, Linné; ii., 188. Near Bethanie, Tanunda (*F. v. M.*); grassy margins of swamps, Mount Graham and Riddoch Bay (*R. Tate*).

Psoralea parva, F. v. M.; 194. Mount Lofty and Barossa Ranges (*F. v. M.*).

Indigofera linifolia, Retz.; 195. Near the River Finke (*H. Kempe*).

Swainsonia Oliverii, F. v. M.; S. Sc. Record, July, 1882. Limestone plateau, near Eucla (*J. Oliver*).

Swainsonia oroboides, F. v. M.; 222. Lower Cooper's Creek (*Howitt*).

Glycine tomentosa, Bentham; 245. Lower Cooper's Creek (*Howitt*).

Galactia tenuiflora, Wight & Arnott; 255. Near the tropics.

Vigna lanceolata, Bentham; 260. Near the tropics.

Cassia pruinosa, F. v. M.; 286. Between Stokes Range and Cooper's Creek (*Wheeler*).

Acacia iteaphylla, F. v. M.; in der Linnæa, xxvi., 617, 1853. Arkaba, collected there by myself in 1851; a well-marked species with the large bracts of *A. suaveolens* and *A. subcœrulea*. Capt. Sturt collected it also in his last expedition—at all events, seeds; from which many years ago I cultivated it in the Botanic Gardens of Melbourne (*F. v. M.*).

Acacia Gilesiana, F. v. M.; Melbourne Chemist, July, 1882. Mount Eba (*E. Giles*).

Acacia Kempeana, F. v. M.; Melbourne Chemist, July, 1882. Near the Finke River (*H. Kempe*).

Acacia cibaria, F. v. M.; Melbourne Chemist, July, 1882. Includes the var. *stenocarpa* of *A. aneura;* and may be identical with *A. brachystachya* of Bentham, inasmuch as flowering specimens of *A. aneura* and *A. brachystachya* cannot readily be distinguished, and both species occur in the same region; the length of the spike is variable. Under these circumstances it seems advisable to abolish the latter specific name. Whether the large-fruited Acacia from Shark Bay really is conspecific remains involved in doubt, as I have seen neither leaves nor flowers of it. Possibly the natives of central South Australia utilise the seeds of *A. cibaria* also for food (*F. v. M.*).

Acacia estrophiolata, F. v. M.; S. Sc. Record, July, 1882. Near the Finke River (*H. Kempe*).

Acacia sessiliceps, F. v. M.; Melbourne Chemist, July, 1882. A well-marked species of the series Calamiformes, but ripe fruit not yet seen for completion of diagnosis; also the peculiarity of stature continues as yet unknown (*F. v. M.*). Near the Finke River (*H. Kempe*).

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Acacia lysiphloia, F. v. M., 393. Near the Finke River (*H. Kempe*).
Acacia dictyophleba, F. v. M.; 388; Frag. iii., 128. Mount Humphries (*Stuart Exped.*); near the Finke River (*H. Kempe*).
Acacia lanigera, A. Cunningham; 324. Near Ardrossan (*O. Tepper*)
Acacia acanthoclada, F. v. M.; 352. Near Fowler's Bay (*Mrs. Richards*).
Acacia Mitchelli, Bentham; 417. Extends to the country about the entrance to the River Glenelg, within South Australian boundary, as noticed by *F. v. M.* in 1857.
Acacia dealbata, Link; 415. In the South-East, from Wattle Range to Wratenbully (*Tenison Woods*).
Acacia Farnesiana, Willdenow; 419. Near the Finke River (*H. Kempe*). Thus four pinnate-leaved Acacias occur in South Australia.

ROSACEÆ.

Stylobasium spatulatum, Desfontaines; ii., 437. Elder Springs, near Mann Range (*J. Forrest*).

HALORAGEÆ.

Haloragis trigonocarpa, F. v. M.; Frag. x., 84. Near Rawlinson's Range (*E. Giles*).
Myriophyllum amphibium, Labill.; ii., 489. Between Mount Compass and Square Waterhole, Encounter Bay (*R. Tate*).
Myriophyllum pedunculatum, J. Hooker; 489. Near the Glenelg River (*F. v. M.*).

MYRTACEÆ.

Bæckea diffusa, Sieber; iii., 76. Square Waterhole, Encounter Bay (*R. Tate*).
Melaleuca trichostachya, Lindley, in Mitchell's Trop. Aust., p. 277. Cooper's Creek (*Howitt Exped.*).
Melaleuca hakeoides, F. v. M.; 151. Near Cooper's Creek (*Dr. Beckler*).
Eucalyptus cneorifolia, DeCandolle; 217. Salt Creek and near Port Lincoln; Kangaroo Island (*Fl. Aust.*, iii., 217).
Eucalyptus tesselaris, F. v. M.; 251. Near the Finke River (*H. Kempe*).
Eucalyptus terminalis, F. v. M.; 257. Near the Finke River (*H. Kempe*).
Eucalyptus macrorrhyncha, F. v. M.; 207; Eucalyptographia i. The chief forest tree of the "stringy-bark" ranges about Sevenhills, near Clare (*R. Tate* and *J. E. Brown*).

STACKHOUSIEÆ.

Stackhousia muricata, Lindley; i., 408. Near the Finke River (*H. Kempe*).
Stackhousia flava, Hooker; 407. Ardrossan (*O. Tepper*).

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RHAMNACEÆ.

Pomaderris myrtilloides, Fenzl.; i., 419. Near Eucla (*J. Forrest*).
Trymalium Wayæ, F. v. M. and Tate. Gorge of the Onkaparinga (*R. Tate*).
Cryptandra obovata, J. Hooker; i., 429. Square Waterhole, Encounter Bay (*R. Tate*).

PROTEACEÆ.

Adenanthos sericea, Labill.; v., 354. Kangaroo Island (*Waterhouse, Tate*).
Grevillea agrifolia, A. Cunn.; v., 455. MacDonnell Ranges (*Stuart Exped.*).

LORANTHACEÆ.

Loranthus linearifolius, Hooker; iii, 391. North-west interior (*Stuart's Exped.*).
Loranthus Quandang, Lindley; iii., 395. Cooper's Creek (*Howitt's Exped.*).

UMBELLIFERÆ.

Sium latifolium, Bauhin. Mount Lofty Range (*F. v. M.*)
Oreomyrrhis andicola, Endl.; iii., 377. Mount Gambier, on volcanic soil (*F. v. M.*).

COMPOSITÆ.

Aster stellulatus, Labill.; iii., 473. Near the Glenelg River (*F. v. M.*).
Aster asterotrichus, F. v. M.; 473. Near the Glenelg River (*F. v. M.*).
Aster Mitchelli, F. v. M.; 478. On sandhills towards the Great Bend of the Murray River (*F. v. M.*).
Aster orarius, F. v. M.; 482. A sea-coast plant, near the Glenelg River (*F. v. M.*).
Calotis microcephala, Bentham; 504. Hermannsburg, Finke River (*H. Kempe*).
Brachycome chrysoglossa, F. v. M. R. Murray plains, towards the Darling River (*F. v. M.*).
Epaltes Cunninghamii, Bentham; 530. Murray Desert (*F. v. M.*).
Wedelia verbesinoides, F. v. M.; 538. Finke River (*Stuart Exped.*).
Millotia Kempei, F. v. M.; South. Sc. Record, January, 1882. Hermannsburg, Finke River (*H. Kempe*).
Leptorrhynchos tenuifolius, F. v. M.; 609. Mount Burr (*Mrs. Wehl*).
Leptorrhynchos panætioides, Bentham; 609. Murray Desert (*F. v. M.*).
Helichrysum cinereum, F. v. M.; 629. Rivoli Bay (*Mrs. Wehl*).

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Helichrysum Tepperi, F. v. M; S. Sc. Record, Jan., 1882. Ardrossan *(O. Tepper)*.

Helichrysum Kempei, F. v. M.; Melbourne Chemist, January, 1882. Near the Finke River *(H. Kempe)*.

Helichrysum Dockerii, F. v. M.; 626. Towards the Barrier Range (*Dr. Beckler*).

Humea squamata, F. v. M.; Frag. xi., 86. Murray Scrub, at the boundary line of South Australia and Victoria.

Gnephosis cyathopappa, Bentham; 571. Towards the Barrier Range.

Bidens bipinnatus, Linné; 543. Near the Finke River *(H. Kempe)*.

CANDOLLEACEÆ.

Candollea (Stylidium) perpusilla, J. Hook.; iv., 15. Near the Glenelg River (*F. v. M.*).

CAMPANULACEÆ.

Lobelia pedunculata, R. Brown; 133. R. Onkaparinga (*F. v. M.*); at Clarendon (*Tate* and *Tepper*); marshes around Mount Burr Range, S.E. (*R. Tate*).

GOODENOVIEÆ.

Goodenia sepalosa, F. v. M.; iv., 72. Near the Finke River (*H. Kempe*).

Goodenia heteromera, F. v. M.; 76. Murray Desert (*F. v. M.*).

Goodenia humilis, R. Brown; 79. Mount Burr (*Mrs. Wehl*). Mount Graham; Tarpeena; and Cave Range Forest Reserve (*R. Tate*).

Scævola Grœneri, F. v. M.; 88. Bunda plateau, ten to twenty miles from Eucla (*R. Tate*).

Dampiera candicans, F. v. M.; Frag. x., 86. Near the Rawlinson Range (*E. Giles*).

Dampiera marifolia, Bentham; 114. Murray Desert, near the Victorian boundary.

ASCLEPIADEÆ.

Dæmia Kempeana, F. v. M.; S. Sc. Record, August, 1882. Near the Finke River (*H. Kempe*).

SOLANACEÆ.

Solanum orbiculatum, Dunal; iv., 453. Near Eucla *(J. Oliver)*.

SCROPHULARINEÆ.

Mazus pumilio, R. Brown; iv., 484. Marshes from the Glenelg to Cape Northumberland (*R. Tate*); Lake Bonney; Mount Gambier (*F. v. M.*); around Mount Burr Range (*R. Tate*).

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Gratiola pedunculata, R. Brown; 492. River Murray (*F. v. M.*).

Glossostigma elatinoides, Bentham; 502. River Murray (*F. v. M.*).

Peplidium Muelleri, Bentham, 500, Lake Eyre (Frag. ix., 166).

Veronica peregrina, Linné; 511. Rocky River (*F. v. M.*); Mount Lofty Range (*R. Tate*); wet pastures and rocks in the South-East (*R. Tate*).

ACANTHACEÆ.

Ruellia primulacea, F. v. M.; iv., 546. MacDonnell Ranges (*E. Giles*); Alice Springs and Charlotte Waters (*C. Giles*); Barcoo River (*J. McD. Stuart*).

Justicia Bonneyana, F. v. M.; S. Sc. Record, April, 1882. In the eastern interior, within S. Australian territory.

CONVOLVULACEÆ.

Polymeria longifolia, Lindley; iv., 432. Near the Finke River, (*H Kempe*); Cooper's Creek.

Polymeria angusta, F. v. M.; 432. Near the Finke River (*H. Kempe*); Cooper's Creek.

Breweria media, R. Brown; 436. Near Cooper's Creek.

Wilsonia Backhousii, J. Hooker; 440. Salt lagoon near D'Estrees Bay, Kangaroo Island (*R. Tate*); near Eucla (*J. Oliver*); Lake George, Rivoli Bay; and near Kingston, Lacepede Bay (*R. Tate*).

ASPERIFOLIEÆ.

Rochelia MacCoyana, F. v. M.; iv., 408. Murray Desert (*F. v. M.*).

LABITÆ.

Prostanthera chlorantha, F. v. M.; v., 108. Mount Barker Creek; Encounter Bay; Kangaroo Island (Fl. Aust., v., p. 108); Yorke's Peninsula (*Tietkens*).

Teucrium integrifolium, F. v. M.; 133. Near the tropics.

VERBENACÆ.

Verbena macrostachya, F. v. M.; v., 36. Near the Finke River (*H. Kempe*).

Newcastlia cladotricha, F. v. M.; 40.

Clerodendrum floribundum, R. Brown; 63. Near the Finke River (*H. Kempe*).

SELAGINEÆ.

Dischisma capitatum, Chois; v. 31. Pine forest between Reed-beds and Port Adelaide (*R. Tate*). Probably introduced.

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Myoporinæ.

Eremophila Bowmani, F. v. M.; v. 18. Near Cooper's Creek.
Eremophila strongylophylla, F. v. M.; Frag. x., 87. Western interior (*E. Giles*).
Eremophila Turtoni, F. v. M.; Frag. x., 87. Rawlinson's Range (*E. Giles*).
Eremophila Mitchelli, Bentham; 21. Hermannsburg, River Finke (*H. Kempe*).
Eremophila exilifolia, F. v. M.; Frag. x., 88. Rawlinson's Range (*E. Giles*).
Eremophila bignoniflora, F. v. M.; 25. Murray Desert (*F. v. M.*); Mallee scrub, Tatiara (*Tenison Woods*).

Epacrideæ.

Styphelia striata, Spreng.; iv., 195. Heath between American River and D'Estrees Bay, Kangaroo Island (*R. Tate*).
Brachyloma ciliatum, Bentham; iv., 173. Mount Jagged, Encounter Bay (*O. Tepper*).

MONOCOTYLEDONEÆ.

Hydrocharideæ.

Hydrilla verticillata, Casp.; vi., 259. Waters of the Murray River within S. A. boundaries (*F. v. M.*).
Ottelia ovalifolia, Rich.; vi., 257. Cygnet River, Kangaroo Island (*R. Tate*). Near the Glenelg River; near Mount Barker (*F. v. M.*). "I had it in my manuscript list of S. A. plants already in 1848, as I found it in several water-holes in the Mount Barker District. Possibly it may there have disappeared. I noticed it also near the entrance of the Glenelg River, within S. A. territory" (*F. v. M.*).

Orchideæ.

Spiranthes australis, Lindley; vi., 314. Valleys in sandhills, Rivoli Bay (*Mrs. Wehl*).
Prasophyllum despectans, J. Hooker; vi., 345. Clarendon (*O. Tepper*).
Pterostylis pedunculata, R. Br. Clarendon (*O. Tepper*); Battunga, near Macclesfield (*R. Tate*).
Pterostylis præcox, Lindley; vi., 359. Hog Bay and Kingscote, Kangaroo Island (*R. S. Rogers*, 6-'82).
Eriochilus fimbriatus, F. v. M.; vi., 379 (*Caladenia*). Clarendon (*O. Tepper*).

Commelineæ.

Commelina ensifolia, R. Brown; vii., 83. Hermannsburg, Finke River (*H. Kempe*).

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LEMNACEÆ.

Wolffiia arrhiza, Wimm.; vii. 162. Lake adjacent to Valley Lake, Mount Gambier; mixed with *Lemna minor* (*R. Tate*).

RESTIACEÆ.

Calastrophus lateriflorus, F. v. M.; vii., 238. East slope of Mount Lofty; Square Waterhole (*R. Tate*); Penola Heath (*Tenison Woods*).

CYPERACEÆ.

Cyperus tenellus, Linné; vii., 265. Square Waterhole, Encounter Bay (*R. Tate*).

Cyperus gracilis, R. Brown; vii., 265. About Lake Eyre.

Cyperus textilis, Thunberg [C. vaginatus var. densiflorus, Bentham]; vii., 273. Near the Finke River (*H. Kempe*); Alice Springs (*E. Giles*); Port Lincoln (*Bowen*).

Scirpus littoralis, Schrader; vii., 334. Hermannsburg, Finke River (*H. Kempe*).

Lepidospora tenuissima, F. v. M.; vii., 365. Square Waterhole, Encounter Bay (*R. Tate*).

Lepidosperma lineare, R. Brown; vii., 395. Clarendon; Meadow's Creek (*O. Tepper*).

Cladium schœnoides, R. Brown; vii., 407. Square Waterhole, Encounter Bay (*R. Tate*).

Cladium trifidum, F. v. M.; vii., 413 (Gahnia). R. Onkaparinga, South of Clarendon (*O. Tepper*).

Caustis pentandra, R. Brown; vii., 420. Heath between American River and D'Estrees Bay, Kangaroo Island; Square Waterhole, Encounter Bay; wet heath, Mount Julian, near Penola (*R. Tate*).

GRAMINEÆ.

Eriochloa punctata, Hamilton; vii., 462. Near the Finke River (*H. Kempe*); Darling River, extending to South Australia (*F. v. M.*).

Aristida ramosa, R. Brown; vii., 563. Hermannsburg, River Finke (*H. Kempe*).

Dichelachne sciurea, J. Hooker; vii., 594. Kangaroo Island (*R. Tate*).

Perotis rara, R. Brown; vii., 509. Hermannsburg, R. Finke (*H. Kempe*).

ACOTYLEDONEÆ.

LYCOPODIACEÆ.

Lycopodium laterale, R. Brown; vii., 675. Between Mount Compass and Square Waterhole (*R. Tate*).

FILICES.

Schizæa fistulosa, Labill.; vii., 69. Clarendon (*O. Tepper*); between Mount Compass and Square Waterhole (*R. Tate*).

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MUSCI.

Bruchia exigua, Hooker and Wilson. Mount Lofty Range (*Dr. Behr*).
Rhabdoweisia cyathocarpa, Montague. Clarendon (*O. Tepper*).
Campylopus introflexus, Hedwig. Mount Gambier (*F. v. M.*); Clarendon (*O. Tepper*).
Glyphomitrium acutifolium, J. Hook. and Wils. South Australia (*Prentice*).
Weisia riparia, Hampe. Gawler River (*F. v. M.*).
Bryum dichotomum, Hedwig. Clarendon (*O. Tepper*).
Tayloria octoblepharis, Hooker. Clarendon (*O. Tepper*).

[Corrigendum:—*Hypopterygium N. Zealandiæ* of former list is *H. discolor*, Mitten.]

LICHENES.

Lichina pygmæa, Agardh. On coast cliffs, St. Vincent Gulf (*F. v. M.*).
Cladonia squamosa, Hoffmann. Clarendon (*O. Tepper*).
Cladonia fimbriata, Schaerer. Clarendon (*O. Tepper*).
Cladonia pyxidata, Hoffmann. Common.
Thysanothecium hyalinum, Nylander. Clarendon (*O. Tepper*).
Stictina crocata, Acharius. Clarendon (*O. Tepper*).
Parmelia molliuscula, Acharius. Clarendon (*O. Tepper*).
hypoxantha, J. Mueller. Clarendon (*O. Tepper*).
versicolor, J. Mueller. Clarendon (*O. Tepper*).
Physcia speciosa, Fries. Clarendon (*O. Tepper*).
Urceolaria scruposa, Acharius. Clarendon (*O. Tepper*).
Normandina Jungermanniæ, J. M. With Stictina crocata, Clarendon (*O. Tepper*).

FUNGI.

Agaricus vaginatus, Bulliard. Mount Gambier (*F. v. M.*).
Agaricus salignus, Fries. Lake Bonney (*Mrs. Wehl*).
Agaricus mastoideus, Fries. Barossa Range (*Heuzenroeder*).
Polyporus oblectans, Berkeley. Clarendon (*O. Tepper*).
Polyporus ochroleucus, Berkeley. Clarendon (*O. Tepper*).
Tremella mesenterica, Retzius. Clarendon (*O. Tepper*).
Podaxon carcinomale, Fries. Barossa Range (*Heuzenroeder*).
Cyathus desertorum, F. v. M. Ardrossan (*O. Tepper*).
Cordyceps purpurea, Fries. Ergot on cereals.
Psilosphæria Schomburgkii, Berkeley.
Auricularia minuta, Berkeley. Clarendon (*O. Tepper*).

ALGÆ.

Sargassum verruculosum, Agardh. St. Vincent's Gulf (*O. Tepper*).
Cystophora camplyocoma, Kuetzing. St. Vincent's Gulf, west (*O. Tepper*).
Zonaria crenata, Agardh. St. Vincent's Gulf (*O. Tepper*).
Zonaria nigrescens, Sonder. St. Vincent's Gulf (*O. Tepper*).

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Dilophus fastigiatus, Sond. (*Dictyota*). St. Vincent's Gulf (*O. Tepper*).
Hymenocladia divaricata, Agardh. St. Vincent's Gulf (*O. Tepper*).
Peyssonnelia Tepperi, Sonder. St. Vincent's Gulf, west (*O. Tepper*).
Pollexfenia (?) ciliaris, Agardh. (*n. sp.*) On account of absence of fruit, the genus is not with certainty determinable. St. Vincent's Gulf (*O. Tepper*).
Dictyosphæria sericea, Harvey. St. Vincent's Gulf (*O. Tepper*).
Caulerpa flexilis, Lamourx. St. Vincent's Gulf (*O. Tepper*).
Vaucheria clavata, Agardh. Holdfast Bay (*F. v. M.*).
Schizogonium pallidum, Kuetz. Holdfast Bay (*F. v. M.*).
Cladophora Bainesii, Muell. and Harv. St. Vincents Gulf (*F. v. M.*).
callicoma, Kuetz. St. Vincent's Gulf (*F. v. M.*).
Thoreana, Kuetz. St. Vincent's Gulf (*F. v. M.*).
crystallina, Kuetz. Holdfast Bay (*F. v. M.*).
vaga, Kuetz. Holdfast Bay (*F. v. M.*).
fracta, Kuetz. Holdfast Bay (*F. v. M.*).
subsimplex, Kuetz. St. Vincent's Gulf (*O. Tepper*).
crispata, Kuetz. St. Vincent's Gulf (*O. Tepper*).
Chætomorpha Indica, Kuetz. Port Adelaide (*F. v. M.*).
implexa, Kuetz. Port Adelaide (*F. v. M.*).
Zygnema Dillwynii, Kuetz. St. Vincent's Gulf (*F. v. M.*).
Zygonium affine, Kuetz. St. Vincent's Gulf (*F. v. M.*).
Calothrix confervicola, Agardh. St. Vincent's Gulf (*F. v. M.*).
Epithemia sorex, Kuetz. Holdfast Bay (*F. v. M.*).
Melosira Dozyana, Kuetz. Adelaide (*F. v. M.*).
Navicula arcta, A. Schmidt. Adelaide (*F. v. M.*).

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MISCELLANEOUS CONTRIBUTIONS

TO THE

NATURAL HISTORY OF SOUTH AUSTRALIA.

Edited by PROFESSOR TATE, Director of the Natural Science Correspondence Department.

BOTANY.

ADDITIONAL LOCATITIES OF ACACIAS known already from South Australia. By Baron Sir F. von Mueller.

Acacia minutifolia, Acacia patens, and Acacia tetragonophylla; Finke River (*Rev. H. Kempe*).

Acacia colletioides (A. nyssophylla). Near Fowler's Bay (*Mrs. Richards*); between the Elizabeth River and Ooldea (*Jesse Young*).

Acacia strongylophylla. Finke River (*Rev. H. Kempe*). Nearest to A. pyrifolia.

NOTE ON THE OCCURRENCE OF ERIOCHILUS FIMBRIATUS in South Australia. By Baron Sir F. von Mueller.

Through the circumspect and continued searches for plants instituted by Mr. Otto Tepper many additional plants from South Australia became recorded, and now he has afforded the means of adding a highly-remarkable orchid found by him quite recently in the vicinity of Clarendon. It is the same plant of which I saw leaves on the Onkaparinga Ranges in 1848, and in two or three of the subsequent years; but I noticed the plant only very scantily, and did not succeed in ever obtaining a flower. This I had occasion to state in a note before the Victorian Field Naturalists' Club, at its last meeting, when flowering specimens collected by Messrs. French and Luehmann in heath ground at Port Phillip were exhibited. This orchid escaped notice because it is one of the earliest harbingers of the spring, and produces blossoms at a time when excursions are seldom made in search of flowering plants. It is, however, known since many years from West Australia—Professor Lindley already, in 1839, having described it as Leptoceras fimbriatum (and also L. pectinatum) from Mr. Drummond's collections. Subsequently it was, as indicated by others previously, joined to *Caladenia*; but it is anomalous in that genus, being devoid of the glands on the upper side of the labellum; it accords

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better with *Eriochilus* in the pubescent surface of the labellum as also in habit, differing, however, from the other species of Eriochilus in not dilated lower lobes of the calyx and in the very broad and anteriorly fringed labellum; the occurence of an empty bract on the stem being for generic purposes immaterial, as demonstrated by the genus *Caleya*.

List of Plant Species collected by Mr. J. C. Chandler, Corr. Memb., in the neighbourhood of Peake, Central Australia. By Prof. Tate and Baron Sir F. von Mueller:—

Lepidium phlebopetalum; Abutilon halophilum, A. Fraseri; Sida intricata, Euphorbia erythrantha, Erodium cygnorum, Tribulus terrestris, Claytonia Balonnensis, Ptilotus exaltatus, Kochia villosa, Bœrhaavia diffusa, Crotalaria dissitiflora, Indigofera brevidens, Swainsonia campylantha, Lotus australis var. Behrianus, Cassia Sturtii; Minuria leptophylla, M. Candollei; Calotis hispidula, Pterocaulon sphacelatus, Pterigeron liatroides, Flaveria australasica, Millotia Greevesii, Helichrysum podolepideum, Helipterum floribundum; Goodenia cycloptera, G. glauca; Solanum lacunarium, S. ellipticum; Nicotiana suaveolens, Justicia procumbens, Eremophila Freelingii.

Zoology.

Notes on Two Species of Moths. By E. Guest, Local Correspondent.

The insects to which the following notes refer have been generically determined by Mr. E. Meyrick, B.A. (*Editor.*)

Antheræa sp. (probably *A. Eucalypta*).—"This is the largest of the Bombyces known to me; the expanse of wings is 5¼ inches in male, 6½ to 7⅓ in female. In shape and markings it closely resembles *A. Pernyii* of China, but the colour is much darker, and the round spot is opaque. The larvæ is bright apple green, with a blue tinge along the back. On each of the second and third segments are two blue warts, similar but smaller on the four, fifth, and sixth, and on the eleventh segment a large one. The spiracles are large, oval, and of an orange colour; and between them and the legs there is an interrupted, raised, and broad stripe of indian red colour. The caterpillar feeds on "white gum" saplings, and spins about the third week in February. The cocoon, which is of the size of a small pullet's egg, is very tough and hard, and contains a great deal of silk, but is so mixed with gum as to render it of no use commercially. It passes the winter in this state attached to

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the leaves of the food-tree, and the imago emerges about October and continues to be found through November. There is only one brood in the year. This handsome moth is not very uncommon, the larvæ and pupæ are largely preyed upon by magpies and wattle-birds." Further reference to this species will be found Trans. of this Society vol. iv., p. 142 (Editor).

Choragia sp.—"Expanse of wings in male $1\frac{3}{4}$ inch, in female $2\frac{1}{2}$ inches. The great peculiarities of this species are the extremely short antennæ of male, extraordinary shape of the first pair of legs, and the almost entire absence of the third pair of legs.

The fore wings of female are dull, smoky red, with a large dull-coloured triangle of green towards apex of wing, beyond which is another smaller one. Hind wings reddish-salmon colour. Abdomen of female extraordinarily long.

The larva is hard-headed, dirty-white. It gnaws the bark in a ring around the branch of Melaleucæ, and makes a large nearly circular pit on one side of the branch, all of which are covered with a dense opaque web of silk; then it eats down into the pith. It feeds for two years, and remains in the pupa state never more than a week. The perfect insect emerges in January, but it is local and rare."

NEW LOCALITIES FOR LAND AND FRESHWATER SHELLS. Species determined by Prof. R. Tate.

Helix Bednalli and *Succinea australis*, at Blewitt's Springs; collected by O. Tepper.

Bulinus bullatus and *Paludina Hanleyi*, in the River Bremer, at Salem, near Callington; collected by J. G. Neumann.

NOTE ON THE OCCURRENCE OF A SECOND SPECIES OF CROCODILE IN ARNHEIM LAND. By Prof. R. Tate.

The common crocodile of the estuaries of the Adelaide, Alligator, and other rivers of Arnheim Land has long been scientifically known, having been identified by Gray as C. porosus.

While at the Port Darwin I saw in the possession of Inspector Foelsche a small gavial-like species, which I refer unhesitatingly to *C. Johnstoni*, Krefft, P.Z.S., 1873, p. 334, and Gray, id., p. 177, tab. 27, 1874, described from a Queensland example. Inspector Foelsche informs me that the species has been known to him for several years, and that it inhabits the inland lagoons and creeks, and appears to be plentiful, and that as far as he can learn it lives only in fresh water. The eggs are long and narrow.

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Palæontology.

On Fossil Chilostomatous Bryozoa from Mount Gambier. By Arthur W. Waters, F.G.S. Quart. Journ. Geol. Soc., vol. 38, pp. 257-276, plates 7-9. August, 1882.

"The number of species from Mount Gambier is 67; of these, we have already found 26 in the material I described from south-west Victoria, four are known from Orakei Bay, New Zealand, and I have 21 from Bairnsdale; 30 are now living, of which 25 have been found in Australian waters. Two species are considered identical with species found in the European Chalk, twelve with European Miocene, and twelve with Pliocene. Besides these forms I have found Mr. Woods has described from Mount Gambier *Eschara cavernosa*, *E. Clarkei*, and *E. verrucosa*, *Woods*."—Extract.

Geology and Mineralogy.

Report on Minerals received from Mr. J. Chandler, Corr. Memb., Peake, by Professor R. Tate.

Micaceous iron, intermingled with quartz, and Red Hæmatite, near Tennant's Creek.

Tourmaline in quartz, Barrow's Creek.

Piece of baked clay from sandhill clay pans. Fragment of a hollow sphere, concave face polished; subjacent layers of clay dense, evidently soft clay been pressed upon by a smooth pebble, afterwards baked by sun's heat.

Red ochre of superior quality, found near Peake. Used by the natives in much the same way as the Parachilna-earth is for decoration.

Hemispheres of agglutinated fine particles of sand, exterior surface resembling that of a peach stone.

Common Opal, from 30 feet in Kelly's Well, 30 miles south of Tennant's Creek.

Black Calcite.—Specimens of a mineral, mistaken for coal, have been analysed in the University Laboratory, and found to be *calcite* coloured with finely-divided carbonaceous matter. The mineral is stated by Mr. S. W. Pearce, of Whyte-Yarcowie, to occupy a vein in a dark-coloured slate of from four to six inches thick, and extending in a north and south direction for more than a mile. *R. Tate.*

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PLANT-BEARING BEDS between LAKE FROME and the BARRIER RANGES. Communicated by the Deputy Surveyor-General.

These leaves were taken from three wells situated between Lake Frome in South Australia and the Mount Browne gold diggings in New South Wales, in latitude about 30°.

The first well is 45 miles west of the province boundary, near the north end of Lake Frome. Section as under:—

Surface soil	10	feet
Clay	70	"
Compressed wood and leaves in bottom	80	" salt water.

The second is situated at Tilcha Station, near the province boundary, about 35 miles north-east of the well above mentioned. Section:—

Surface clayey loam	10	feet
Sandstone	4	"
Blue clay	76	"
Drift sand and gravel intersected with clays	165	"
White quartzose sand with branches of trees and leaves similar to above ...	5	"
	250	" fresh water.

The third well from which specimens of these leaves were taken by Mr. Jones is situated about 35 miles within New South Wales towards Mount Browne. After sinking 114 feet through clays, &c., the stratum containing the wood and leaves was met with. This well is at present in progress. It may be mentioned that Mr. Jones possesses no information concerning the thickness of this stratum; no wells in the district have been sunk through it; and that the same stratum has been met with in well-boring on the upper watershed of the Darling.

SUPPLEMENTARY NOTE by *Professor R. Tate*.—The leaves which are embedded in a blue clay, belong to one species, as far as can be ascertained from their fragmentary condition. The largest fragment 3 inches long by 1¾ wide, belongs to an elliptical leaf, coriaceous in texture, and surface rugose; the mid-rib is thick, and the strong lateral veins which arise therefrom converge towards the margin and become confluent with the marginal vein.

Fragments of a similar clay highly charged with carbonaceous debris contain casts of *Arca*, *sp.*, and of another lamellibranch genus, probably *Cardium*. The formation may be referred to the Miocene epoch.

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SECTION OF STRATA traversed by BORING at WIRRIALPA STATION, FROME DOWNS, about twelve miles south-east of Lake Frome. Communicated by J. A. Niemann, by favour of Mr. J. H. Angas.

Surface not much above sea-level, as far as known. A shaft six feet in diameter was sunk to a depth of 21 feet, when boring was commenced.

NATURE OF STRATA.	THICKNESS IN FEET.
Red clay and gypsum in small pieces	18
Sand, clay, and gypsum in large blocks	11
Solid mass of gypsum	3
Hard close-grained grey sandstone	2
Hard white stone (limestone?)	3
Soft limestone	21
Grey clayey sand [no water]	2
Brown and drab clay	6
Various coloured sands [small supply of salt water] ...	5
Drab clayey sand	20
Bluish drift [salt water a little stronger]	2
Drab sandy clay	3
Various coloured stiff clays	52
Slate coloured stiff clay	18
Gray clayey sand, striped with brown [better water]	8
Slate coloured clay	9
Striped slate coloured clay	8
Gray pipe clay	10
Striped slate coloured clay	10
Grey clayey sand [brackish water]	2
Slate coloured clay	6
Light coloured sandy clay [water]	3
Light green sandy clay	5
Total	227

Boring discontinued through accident to rods.

STATEMENT OF STRATA traversed by the BORING MADE FOR OBTAINING WATER at WATERWORKS YARD, STIRLING NORTH, near Port Augusta. Height above low water mark at Port Augusta, 103·99 feet, found by dumpey level. Recorded by Mr. H. W. Hullett, and communicated by the Hydraulic Engineer.

NATURE OF STRATA.	DEPTH IN FEET BELOW THE SURFACE.
Sandy loam, very dry (red)	26·6
Clean loose gravel [brackish water at 57 feet—eight gallons in 24 hours]	29·0

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NATURE OF STRATA.	DEPTH IN FEET BELOW THE SURFACE.
Loamy marl (red)	62·0
Gravel, loose	65 0
Hard shaly clay (red)	80·0
Marly clay	97·0
Clay, with limestone and gravel	112·6
Red clay, with gravel	117·9
Hard limestone	118·6
Clay, with limestone (red)	137·0
Red sand	139·0
Hard limestone	142·0
Limestone and clay (red)	151·6
Hard limestone	153·6
Red clay	157·6
Hard limestone	158·6
Sandy clay	164·6
Limestone, hard	169·0
Clay, very hard, with stones	187·0
Soft yellow clay	189·0
Red clay, with stones	208·0
White clay, hard	250·0
Blue, hard, shaly clay	270·0
Black clay, very hard	278·0
Blue clay, hard [brackish water at 285 feet; for analysis, see "Appendix"]	285·0
Fine yellow sand	335·0
Light coloured drift sand	340·0
Brown coloured drift sand	345·6
Fine drift sand, with carbonaceous matter ...	350·0
Brown coloured sand	357·0
Black carbonaceous mud	357·3
Black drift sand	358·4
Brown coloured drift sand	361·0
Black clay, stratified	362·6
Slate, black, stratified	365·6
Quartz rock	372·0
Gravel, cemented	386·0
Black quartz rock	389·0
Blue clay, with gravel and rock fragments ...	393·6
Hard sand, rock, black	394·6
Black clay, with rock fragments	409·0
Pipe clay	445·0
Coarse and fine white sand	460·0
*Quartz rock	462·0

* This rock proving so hard to the tools in use, further sinking, for the present at least, is abandoned.

NOTE BY EDITOR.—The rock is probably a boulder of quartzite, and not *in situ*. All the superior beds may be referred to the Pliocene Drift.

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The water overflowing tubes at bottom of shaft is considerably salter than that struck at higher levels, and it is questionable whether stock will drink it.

APPENDIX.—Analysis of water at 285 feet, by Mr. George Francis:—

	GRAINS PER GALLON.
Sodium chloride	540·25
Sodium sulphate	14·5
Calcium, carbonate and sulphate ...	14.56
Magnesia	9·74
Iron sesqui-oxide	0·65
Silica	0·15

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ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia,

FOR 1881-82.

ORDINARY MEETING, NOV. 1, 1881.

His Honor Chief Justice WAY, President, in the chair.

Donations to Library during past month laid upon the table.

Chas. van Lear Florence, Clarendon; Maurice Salom, Adelaide, and William Henry Tietkins, F.R.G.S., Adelaide, were elected Fellows; and T. C. Cloud, F.C.S., Wallaroo, and J. Chandler, Peake, as Corresponding Members.

Mr. F. G. Waterhouse, Curator of the Institute Museum, sent some eccentric forms of Starfishes* found by Mr. A. Molineux at Port Vincent and the North Arm. Also, some English humble bees and their nests, imported by Dr. Mayo, but which had unfortunately died on the voyage out, this being the second unsuccessful attempt made by Dr. Mayo to introduce them into the colony.

Mr. F. S. CRAWFORD exhibited examples of two species of Coccidæ, one living in great numbers on a Kangaroo Island Acacia hedge at Norwood, the other on the young gum trees growing along the banks of the River Torrens at Adelaide. They are peculiar in possessing one pair of small eyes, widely separated on the upper part of the head, and a second and large pair on the underside; the eyes in both pairs are simple and not multiple in structure.

Mr. J. C. B. MONCRIEFF forwarded for exhibition a fragment of a lower jaw of *Diprotodon*, one of the large extinct marsupials, found nine feet below the surface in a bed of gravel which crosses Section 381, Hundred of Yatala, the site of the new railway carriage shops.

Mr. TEPPER exhibited the head of a large trilobite found by him in the Ardrossan limestone.

Professor TATE exhibited specimens of the plant species *Quinetia Urvillei*, not previously known to occur in this colony, though common in West Australia.

*NOTE.—*Asterogonium (Tosia) australe*, Gray (R. Tate.)

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The PRESIDENT showed, on behalf of Mr. Horn, a specimen of the New Zealand vegetable caterpillar, out of whose head had grown a long-stalked fungus which fed on the juices of the caterpillar until they were exhausted, at which time the fungus had attained maturity.

Mr. TODD exhibited two photographs of the new transit instrument provided for the Adelaide Observatory, which had entirely superseded the old instruments used for the purpose. The telescope was provided with two circles 30 inches in diameter, both of which were read off by four micrometer microscopes. A room was now being built for its reception, where it was intended to be placed on granite foundations, and in a short time he hoped to be placed in a much more favourable position for taking observations than he had been formerly. In a short time the meteorological department of the Observatory would be very much enlarged, and the whole institution would be placed on a footing of equality with the great European observatories so far as the instruments were concerned.

Mr. TODD then read his paper on "The Recent Atmospheric Disturbances on the East Coast."

Mr. TODD, C.M.G., F.R.A.S., read a paper on the Transit of Mercury to take place on the 8th instant. He invited gentlemen desirous of taking observations to bring their instruments to the Observatory, and he would supply them with chronometers.

ORDINARY MEETING, DEC. 6, 1881.

His Honor Chief Justice WAY, President, in the chair.

Donations to the Library were announced.

A resolution was agreed to that the hour of meetings be 8 p.m., instead of 7.30 p.m.

Mr. F. G. WATERHOUSE, Curator of the South Australian Museum, exhibited three species of freshwater fish recently taken from hill streams near Mount Compass.

Mr. STIRLING SMEATON exhibited a living specimen of *Echidna hystrix* (Porcupine Ant-Eater) from the South-East.

The PRESIDENT showed some freswater fishes found in creeks near Yankalilla.

Prof. R. TATE, referring to remarks made by Mr. J. G. O. Tepper at last meeting respecting the New Zealand caterpillar, confirmed the same.

Prof. R. TATE exhibited specimens of the following plant-species hitherto unrecorded for South Australia:—*Hybanthus Tatei* and *Pilularia globulifera*, from Wilpena Pound, and *Carex*

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breviculmis, from near Clarendon. These three species made up a total of 29 new to the flora of the colony, which had been added to it since the publication of the census last year, and the success which had attended the exploration of Mr. Tepper, himself, and others was most encouraging. A great deal could be done towards the elucidation of our flora, he pointed out, by working out the life-history of many plants which as yet are known only in the shape of dried specimens. He also took the opportunity of describing Wilpena Pound, where two of the specimens exhibited that evening had been obtained, and of urging that the Pound—which botanically was quite an oasis—should be made a Government Reserve.

Mr. J. H. ANGAS forwarded to the Society a statement of the various strata met with in an unsuccessful bore for water put down in the neighbourhood of Lake Frome. The boring-rod had stuck when at a considerable depth, and another bore was being put down at the spot first selected. The expense may be calculated at about 30s. per foot. (See p. 99.)

Professor TATE said there had been a great deal of criticism in the papers with respect to the teachings of scientific geologists, and they had been twitted with not agreeing; and the tone of some of the letters seemed to point to adverse opinions being given by professional men on a piece of alleged coal found in the Northern Areas. For the sake of geological science he wished to explain how the two opinions were likely to be correct. He then pointed out that the stuff first found on the Woolundunga Forest Reserve, and sent to the Forest Board, was pronounced by the Chairman of the Board and others as a substance that might be carbonised remains of mallee roots. He judged that this deposit had not been found to be a thing likely to pay. The Forester watched closely the operations of the people who had found it; but he had absented himself for two hours once, and on returning coal had been discovered. This second coaly material had afterwards been shown to him, and he had no hesitation in pronouncing it to be good Newcastle coal. (Hear, hear.)

The PRESIDENT—It was taken there.

Professor TATE—Picked up on the railway line, or brought there from Port Augusta. He had gone with the Conservator of Forests to the spot when the discovery was first reported, and from extended geological observations he was sure no coal did occur there. The opinions given on this subject had not been given on the same object, and both were doubtlessly true.

Mr. C. TODD, F.R.A.S., read a paper entitled "Notes on Observations of the Transit of Mercury," but explained that he read it in order simply that the matter might be formally

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brought before the Society, as the facts had already been laid before the public.

Mr. T. D. SMEATON said he had observed the transit, and corroborated the facts which Mr. Todd had published.

Mr. T. B. ADAMSON said he also had observed the transit, but had not seen the black drop that they had looked for. Mr. Todd had referred to an invitation having been given by himself to any gentlemen who had telescopes to go to the Observatory and assist to observe the transit, but had said that no one had responded. He would have been glad, but he had been there on the previous night, and intended to go back, only he found there was no shelter, and it was windy. There had been some very interesting spots on the sun recently. He had seen the large red spot on Jupiter very clearly lately.

Mr. TODD said as to the red spot on Jupiter, which he believed he had been one of the first to observe, it was becoming hazy, as though a volume of cloud were forming over it. He thought it might be that they were looking down upon the lower atmosphere, or perhaps the surface of the planet, and that clouds were now intervening. As Jupiter's satellite had been seen through the edge of the planet, it showed that much of what appeared to be the planet was surrounding atmosphere. He had seen two of the rings of Saturn the other evening very plainly, and should be glad to assist any one who was curious on the point, but it was seldom so good an opportunity presented itself.

Mr. S. POLLITZER, C.E., read a paper entitled "Formulæ for determining Elements of Railway Switches and Crossings," and explained them on the blackboard.

A paper by Mr. E. GUEST, "Notes upon two South Australian Moths," was read. (See p. 95.)

ORDINARY MEETING, FEBRUARY 7, 1882.

His Honor Chief Justice WAY, President, in the chair.

The donations to the Library were laid upon the table.

Wm. Gardner, Esq., M.D., Edward Davies, Esq., William Fowler, Esq., and John Thomas Smyth, Esq., B.A., were elected Fellows.

The Curator of the Adelaide Museum exhibited a specimen of meteoric iron found in the Gawler Ranges, near Yardea, in 1875. The meteorite was found in a superficial limestone about fifteen inches under the surface of the ground, and contains a certain proportion of nickel. Also a "Sea Pen," and a Plaice caught by the South Australian Fishing Company.

Mr. MOLINEUX said, in reference to the Plaice shown, it was found at the mouth of the Port Creek, and was the first one he

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had seen in the colony, although he had paid much attention to fish during his long residence here.

A letter was received from Mr. H. Marshall, of Angaston, asking if there was a public analyst competent to analyse rocks, ores, &c. He mentioned that he had fifty specimens from the district, which he deemed of value. The PRESIDENT said the question of the appointment of a Government Analyst was under the consideration of the Governors of the South Australian Institute and the Council of the University, and an expression of opinion from the Society might have some weight.

On the motion of Mr. ADAMSON, seconded by Mr. C. A. WILSON, it was resolved—"That the Society considers it desirable that a Government Analyst should be appointed."

Mr. C. A. WILSON read a paper upon "A New Species of the family Proclotupidæ":—"I exhibit a specimen new to me of the family *Proclotupidæ*, a minute kind of ichneumon fly, but I cannot name the genus to which it belongs. During last month I went up Sismey's Gully, and found as in olden days many of their egg-shaped cocoons under the hanging bark of the eucalypti, where the caterpillars had fallen, and there changed to chrysalides. They are very common at this time of the year, and are the manufacture of a caterpillar, producing a small brown moth. On opening the box a few days ago I found a single hole in two of these cocoons or nests, from which had evidently issued all these minute flies, the parent insects having inserted all their eggs in the body of the victims before they assumed the chrysalis form. I should add that my little specimens have elbowed antennæ, or what are at half their length hung at right-angles downwards, and keep in constant motion, as if feeling their way. I have seen some of these minute creatures of this family before, but never, I believe, this species."

The SECRETARY read a continuation of the list of plants indigenous to the vicinity of the Peake, MacDonnell Ranges, by the Rev. H. Kempe.

The SECRETARY read a paper contributed by Mr. J. G. O. Tepper, F.L.S., entitled "Observations on the Habits of Ants."

In the discussion that ensued, there was one point in the paper that called for remark, and that was a statement that where ants congregated slugs disappeared. A Fellow said he found that not to be the case, as he knew of at least two gardens where ants and slugs were alike numerous. The small ants made large colonies at Port Vincent, for instance, and that point differed from the statement of the writer of the paper. It was also mentioned that, contrary to a remark made in the paper, all ants were not afraid of water, as some had

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their colonies in a place where they were almost surrounded by water. It was noticed also that ants shunned the heat of the day. In reference to measures for expelling ants, it was stated that kerosine poured through spills of paper into their nests proved effectual; the application of fine wood ashes or sand also caused them to forsake the nest. Other Fellows said they had used hot and cold water, carbolic acid, bi-sulphide of carbon, gunpowder, and other remedies, but without avail.

Another paper by Mr. Tepper, consisting mainly of extracts from the Proceedings of the Linnean Society of London, was read. It contained a description of the Mahwa-tree (*Bassia longifolia*), a well-known tree of India. The introduction of this useful prolific tree into Australia was recommended, with the argument that the natives of the interior would, by the cultivation of the tree, be supplied with a sweet and nourishing diet from the Mahwa, which would thus compensate for the game destroyed by the settlers. It was also mentioned that the tree had been introduced into England with great success, and the flavour of bacon from pigs fed on it was much improved.

ORDINARY MEETING, MARCH 7, 1882.

Dr. E. C. STIRLING in the chair.

Mr. W. J. E. Middleton and Dr. Alex. Henry were elected Fellows.

Mr. CHAS. TODD, F.R.A S., C.M.G., &c., stated that the new transit instrument for the Adelaide Observatory had arrived, but the building was not erected for it. He had also received a new anemograph and a sunshine recorder.

Mr. R. A. WHITE, Superintendent of Signals, South Australian Railways, read a paper on "Safe Working of Railways."

A discussion followed, in which the Chairman, and Messrs. Todd, Pollitzer, Rutt, Cotton, Roberts, and Allen took part.

ORDINARY MEETING, APRIL 4, 1882.

Mr. D. B. ADAMSON in the chair.

The donations to the Library were laid upon the table.

Dr. Robertson, the Rev. N. Rodgers, of Moonta, and Messrs. R. J. Rigaud and L. C. E. Gee were elected Fellows of the Society.

The ASSISTANT-SECRETARY exhibited specimens of stone from the Hundreds of Erskine and Oladdie, and taken from a depth of 60 feet while well-sinking. These specimens, he said, were interesting as showing what kind of rock the distressed farmers had to penetrate in order to obtain water. There

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were 4 feet of alluvial soil at the top; then about 16 feet of a bluish hard clay; then 15 feet of a conglomerate, containing in some cases jasper, and in others ironstone; and next about 10 feet of a hard adamantine rock, under which was a white gravel, which in most cases contained good water. The same kind of sinking was met with at Morgan, except that there was more of the blue clay in that neighbourhood, and one man who sank a shaft there reached a depth of 90 feet, the chief part of the strata passed through being blue clay, after which came the conglomerate, and finally the hard adamant-like rock.

Dr. MAYO exhibited some queen humble bees, which were dispatched to him by Mr. Alfred Neighbour, of London, who wrote that he had sent ten humble queens or mother bees. The package had been placed under the care of the butcher of the Sorata, to be kept in his ice-house, so that the bees might remain in a dormant state. This seemed acknowledged to be the only condition in which it was possible to have the bees safely carried. The receiver of the bees was advised by Mr. Neighbour to open the boxes and allow the bees to fly (if alive) in the middle of a fine day. Nothing could be done in the way of provision for them; they must be allowed to fly and seek their own place for a nest. This plan was followed, when the writer sent some of the bees to New Zealand last year, but only two survived. The time of year when the letter was written (February), or earlier in the winter, was chosen because the fertile mothers only survived and hybernated so as to come forth in the following summer as the founders of a nest or colony. Dr. Mayo remarked that he had tried two or three times to get the bees out alive, but had failed. Seven of the bees arrived, and unfortunately these all proved to be dead. Dr. Mayo was thanked for the trouble he had taken in this matter, and a hope was expressed that his next experiment would prove more successful.

Mr. C. A. WILSON made a few remarks on M. Maxime Cornu's work entitled "Studies on the *Phylloxera vastatrix*," which he temporarily placed at the disposal of the members of the Society. He received the volume from the Commissioner of Crown Lands through the agency of Sir Arthur Blyth and Mr. A. R. Wallace, about a year ago. It was written in French, and had added to it many plates of the insects spoken of shown in all their stages, and beautifully tinted. The work was accompanied by a translation in English.

Mr. T. D. SMEATON read a paper by Mr. J. G. O. Tepper, F.L.S., entitled "Notes and Descriptions of some Rare South Australian Lepidoptera," with coloured figures. Mr. Smeaton also read a paper by Mr. Tepper entitled "Notes on some New Australian Plants."

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ORDINARY MEETING, MAY 2, 1882.

His Honor Chief Justice WAY (President) in the chair.

The donations to the Library were laid upon the table.

The HON SECRETARY announced the gift by the Waterworks Department of a complete set of the strata gone through in a well-boring at the Waterworks Yard, near Kent Town.

Mr. D. B. ADAMSON exhibited a planosphere of the Southern Hemisphere, whereby the position or time of rising or setting of any indicated star or planet may be discovered almost instantaneously, and at any time of the day or night.

Professor R. TATE directed attention to a pseudo-morphite of *quartz* after *calcite*, forwarded by Mr. J. G. O. Tepper from Clarendon. The same gentleman had also forwarded a piece of *fluor spar* and a presumed fossil in slate from Field's River.

Mr. S. POLLITZER mentioned that, during an excursion to the neighbourhood of Field's River in search of the traces of the glacial period in this colony some time ago discovered by Professor Tate, he had found a large block of granite, quite distinct from the prevailing geological character of the district; and Professor TATE stated, in reply, that Mr. Stirling Smeaton had also found traces of the same erratic at various points on the coast cliffs north and south of Hallett's Cove, the bay into which Field's River discharges.

Dr. E. C. STIRLING exhibited and explained William's Freezing Microtome, intended for making large sections of animal tissues for microscopical purposes by the medium of ice and gum solution. The instrument may be popularly described thus:—A cylindrical wooden box, about six inches diameter and six inches high, having a metal cylinder in the centre, is filled with equal parts of ice and salt. This is then covered with a glass lid, having in the centre a small round or square metal plate. On this plate the tissue to be operated upon is gummed after being saturated with highly concentrated gum solution. This metal plate comes into contact with the cylinder passing through the middle of the ice and salt mixture, and the gum above is consequently frozen; but as it freezes in its natural state without undergoing crystallization, it enables the razor to cut the frozen tissue without fracturing it. The razor is mounted in a frame, regulated by sett-screws, enabling the operator to shave off a section $\frac{1}{600}$ of an inch in thickness, or even thinner. Dr. Stirling exhibited several large sections of animal tissues, mounted for microscopical purposes, as made by the use of this instrument, and remarked that one possessed an historical interest. He explained that when in England lately he made application to the Home Secretary for licence to try some experiments upom dumb

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animals, with a view to testing the virtues of ligatures made from the sinews from kangaroo-tails, which he believed to be far superior to those made of "catgut" so called, because the latter, being made by a process of partial decomposition, were liable to melt away within twenty-four hours when used as a ligature around an artery, and thus occasioning great danger to the patient; but the sinews from the kangaroo-tails, being in a natural state, would last for many days, and in the meantime a proper closure of the artery would take place, and the ligature would in time be absorbed. The Home Secretary, in his wisdom, refused the application, and he was obliged to wait for an opportunity to try the experiment upon a human subject. This opportunity occurred, and proved to be eminently successful, though the patient died after a lapse of ten days. The death, however, occurred through other causes, and the ligature was then examined, and it was found that the artery was properly closed, whilst the ligature was in process of absorption, as shown by the section of the artery exhibited by him.

Professor TATE mentioned that whilst in the Northern Territory Inspector Foelsche had shown him in life the several plants used by the natives there medicinally, including the *Sarcostemma australe*, which is used by the natives as a remedy for smallpox. As the disease supposed to be smallpox had not prevailed amongst the natives there since the occupation by the present white population, there were no means of ascertaining the reputed virtue of the plant, which extended as far south as the vicinity of Wallaroo.

The PRESIDENT asked if it was known when the last epidemic of supposed smallpox occurred in South Australia, and the Assistant-Secretary stated that in the early part of 1839, when he arrived here, many of the natives were much pitted with marks, which they ascribed to a visitation just previous to the advent of the white men on these shores. Other speakers followed, and it was mentioned as a curious circumstance that the disease, which appeared to be so fatal to the aborigines, seemed never to have been communicated to the white settlers; but it was also pointed out that the epidemic in South Australia occurred before its settlement by Europeans, whilst that in the Northern Territory occurred after the abandonment of Port Essington, and before the advent at Port Darwin of the present settlers.

The ASSISTANT-SECRETARY mentioned that he had noticed great quantities of blood exuding through the skin and at the caudal extremities of some Port Jackson sharks which he had caught and carefully abstained from wounding in any manner. The body on the softer parts assumed a red blotched appear-

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ance, and the blood seemed to come out like a perspiration whilst the sharks were dying.

The Hon. Secretary stated that Mr. W. L. Wragge, one of the members, had received the gold medal of the Scottish Meteorological Society for a valuable series of observations taken during several months on Ben Nevis, Mr. Wragge taking the higher station, and Mrs. Wragge recording at the lower one at Fort William.

The paper upon "Diurnal Lepidoptera of Balhannah District," being almost purely technical, was taken as read, Professor Tate giving a brief *résumé* of its contents; and the same course was adopted with Mr. J. G. O. Tepper's paper upon "Some South Australian Lizards."

Ordinary Meeting, June 13, 1882.

Mr. D. B. Adamson in the chair.

The donations to the Library since last meeting were laid upon the table.

Dr. H. Whittell, Messrs. R. B. Robin, T. W. Harris, G. E. Farrar, J. W. Tyas, and F. W. Davis were elected Fellows, and Mr. Maurice Holtze, Curator of the Botanic Garden, Palmerston, was elected a Corresponding Member.

Honey-bearing ants.

Professor Tate directed attention to some samples of honey-bearing ants, similar to some submitted to the Society on two previous occasions. They were the remarkable honey-bearing ants which had been described by Sir John Lubbock as coming from Adelaide, but it was now known where they were really to be found. The locality was Barrow's Creek. One of the Society's Corresponding Members (Mr. Chandler) had sent down specimens of the ant (*Campotropus inflatus*) from Barrow's Creek, and another species collected by Mr. Michael May.

Mr. Smeaton remarked that although the Mexican honey-bearing ant fed the other varieties of its species while it lived, yet when it died they made no attempt to open the abdomen, where the honey was secreted.

Professor Tate exhibited a small orchid forwarded by Mrs. Richards of Fowler's Bay. It was a Tasmanian specimen (*Pterostylis mutica*), the westerly distribution of which had now been extended several hundred miles.

The Secretary exhibited a specimen of quartz crystal from the roof of the bed rock at Inglewood, Victoria, at a depth of 80 feet from the surface. It seemed to have included in it what appeared to be tufts of grass.

Professor Tate thought the appearance was due to radial fracture.

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Professor TATE read a paper upon the winter-flowering state of *Hypoxis pusilla* (Hooker). (See p. 76.)

SMALLPOX AND AUSTRALIAN ABORIGINES.

A communication from Mr. W. H. Tietkens, F.R.G.S., was read in reference to a previous discussion on the subject of smallpox amongst the natives of Australia. He stated that the Rawlinson Ranges, which are situated in S. latitude 24° 30′, E. longitude 127° 42′, were visited by Ernest Giles and himself in 1873. The Range, quite in the heart of the continent, was surrounded on all sides by a vast extent of uninhabited country, quite of a desert character, waterless, and covered with dense scrub of mallee and mulga, and only under the most favourable circumstances could it be traversed by the natives, and until he and his companion went there it certainly had never been visited by whites. There they found a people quite isolated from the rest of the world, breathing the pure dry air of the interior, who wandered in small communities from place to place, who seldom camped or remained a whole day in one place, deeply marked with smallpox. What measures they took to prevent contagion or alleviate their sufferings, or how many were carried off, would probably be never known. Of fifteen or twenty men who visited the camp eight were unmistakeably marked with smallpox. Professor Tate, while at Palmerston, was shown a plant which the natives of that country, it was supposed, used as an antidote. In the list of plants by Baron von Mueller collected upon the expedition the *Sarcostemma australe* is mentioned as having been found upon the Rawlinson Ranges.

The germs of the disease suspended in the air, might, in densely populated countries, propagate contagion, but those would be destroyed by the hot winds and summer's sun in crossing such tracts of waterless and uninhabited country. If, then, a people were found under such circumstances who were subject to the disease, how could we expect immunity who were at times somewhat negligent, the writer asked.

Mrs. Richards on this subject wrote that at the end of 1866 and the early part of 1867 the natives of Streaky Bay and Fowler's Bay had what was supposed to be smallpox, great numbers of them dying. A few of the affected were still living, and very much pitted, more especially an old lubra, who was blind; although constantly with them, no white person was known to have taken the disease.

Professor TATE said Mrs. Richards mentioned the fact that Dr. Gething was sent by the Government to attend to the natives at Streaky Bay, and he (the speaker) wrote to him touching his experience. The doctor called upon him, and he

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said he treated the disease as smallpox, to which it had a close similitude, presenting similar symptoms, but he was not prepared to deny that it was not smallpox. The natives at Streaky Bay declared that the disease came to them from the North. He had hoped to have had dates to go upon, but there was not sufficient data to enable him to trace the line of the dissemination of the disease, or settle the question whether it was an endemic disease or had been introduced by the Malays.

NEW PLANTS.

A communication from Mr. O. Tepper was read concerning some new plants. He said three plants had been mentioned as not before known to occur in South Australia. The first was a cyperaceous plant, growing in clefts of rock where a spring of water was oozing out; the long narrow leaves, 6-9 feet, growing in large tufts, gracefully draped the precipice and fallen boulders where it was found. Its scientific name was *Cladium trifidum* (F. v. M.), hitherto known from Tasmania, and occurred to the writer's knowledge only at one very picturesque spot on the Onkaparinga River three miles south of Clarendon. The second plant was a small orchid, *Prasophyllum despectans* (J. Hooker), which had not been known before out of Tasmania. It seemed here very rare in the scrub of the hills. The third was a *Drosera* or sundew, seemingly quite new, which sent its flower-stalk from the dry hard soil, and flowered a month before the leaves appeared. Baron von Mueller considered it a close relation to, but not identical with, *Drosera squamosa*, a West Australian species.

Professor TATE read a paper on the "Strata passed through in the Kent Town Bore Hole."

Professor Ascherson's letter on the propagation of *Cymodocea antarctica* was taken as read.

ORDINARY MEETING, JULY 5, 1882.

His Honor Chief Justice WAY, President, in the chair.

The donations to the Library since last meeting were laid upon the table.

Professor TATE said the Society was honoured with the presence that evening of their only lady and corresponding member, Mrs. Richards, of Fowler's Bay, who had kindly handed in a number of very interesting articles made by the natives of that portion of the country. These articles comprised:—

"Yallow," a wooden vessel.
Hank of yarn of wombat fur.
"Manou," yarn of wombat fur dyed with red ochre.
"Wirri-wirri," a distaff for spinning yarn of wombat fur.

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"Markety," a skull-cap made of netted coloured yarns of wombat fur.

"Wadder," a bag made of netted wombat-yarn; a wooden needle.

"Chena," a sock made of netted wombat-yarn; worn to conceal tracks.

"Youghendah," a circular pad of wombat-yarn, placed on head to support the "yallow."

"Currarah," a head ornament, consisting of two slight sticks crossed at right angles, around which is secured a spiral of yarn; the frame is supported by a stick fixed at right angles to the frame.

"Cuckaling," cord of entwined human hair.

"Talpo chinto," *i.e.*, (white) tails of the "talpo," a small mammal; used for tying up the beard by way of ornament.

"Chewety," a neck ornament composed of entwined wombat-yarns, and decorated with the foxy-coloured tail-tips of the "wallbady," a small mammal—*Myrmecobius*, probably.

"Muderbur," red ochre, with which the natives smear their bodies; also used for dyeing fur.

"Tulah," flint chips used for self-laceration, and affixed to shafts of wood as weapons.

[The articles enumerated have subsequently been acquired by the South Australian Museum.]

A short discussion took place on these articles, and they were acknowledged to be of a most interesting character, and afforded evidence that the natives must have had a knowledge of the art of spinning before the whites inhabited that portion of the country.

The Natural History Director also showed a piece of bone forwarded by Mr. H. Lattorff, and found 30 feet below the surface, about 70 miles north of Port Augusta. This bone was a fragmant of a sacrum, not yet known to what animal it belonged; also from Mr. J. W. Jones, the Deputy Surveyor-General, some fossilised leaves found in three wells, situated between Lake Frome, in South Australia, and the Mount Browne diggings, in New South Wales. A small collection of beetles collected at the Peake by Mr. Chandler was exhibited.

The following papers were read :—

1. Upon the "Land and Freshwater Shells of Tropical South Australia." By Prof. R. Tate.

2. "Diagnosis of a new Dilleniaceous Plant from Arnheim Land." By Baron F. von Mueller and Prof. R. Tate.

3. Dr. WHITTELL read an interesting paper, and illustrated with diagrams and the use of the microscope some recent and extraordinary discoveries made by Dr. E. Abbe, Professor in

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Jena, of optical principles involved in the phenomena of microscopic vision and their application to the construction of the microscope. Dr. Whittell explained Dr. Abbe's interpretation of the manner in which the microscopic image is formed, and of the appearance of certain details in this image, which he shows to be due to the diffractive influence of the internal structural constitution of the object examined upon rays of light transmitted through it.

ORDINARY MEETING, AUGUST 1, 1882.

Mr. D. B. ADAMSON in the chair.

Donations to the Library since last meeting were announced.

Professor R. TATE, F.G.S., produced some specimens of a substance, long known to have existed on the south side of Kangaroo Island, which had been analyzed by Mr. Dixon, of New South Wales, and pronounced by him to be a species of pitch, which Professor Tate believed to be a waif from some wrecked vessel, and was a very good Stockholm pitch. Some resin had been forwarded from Fowler's Bay by Mrs. Ann Richards, and some beeswax and guttapercha had been found by himself at the Head of the Australian Bight; and at Eucla, these led to the conclusion that some ship laden with chandlers' stores had been wrecked on the coast.

A specimen of some black mineral was forwarded under the impression that it was coal, and a statement accompanied it that the sender had submitted it to the Surveyor-General, who could not state what it was, and a large block of land had been taken up under the mineral regulations, with the idea that a coal mine existed there. Professor Tate had proved the substance to be calc spar, coloured with carbonaceous matter.

Mr. H. CHANDLER, of the Peake, forwarded a number of specimens from that neighbourhood, consisting of hæmatite, naturally-baked clay polished on one side, some red ochre, hemisphere of agglutinated sand, common opal, quartz and micaceous iron said to contain gold (from the Peake), micaceous iron, tourmaline.

Mr. HOGARTH sent specimens from a well-sinking 260 feet deep, on the Mombra Station, near Mount Browne, on the frontier of New South Wales, containing almost solid masses of iron pyrites and shells, which Professor Tate referred to the Jurassic genus *Aucella*.

Professor TATE then read a paper, contributed by Baron Ferdinand von Mueller, upon "Some additional South Australian Acacias."

A paper by Mr. GAVIN SCOULAR, Corresponding Member, was

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read in abstract form by Professor TATE, in the absence of the author, on "The Geology of the Neighbourhood of Gawler."

Some "Notes relating to the Geology between Burra and Farina" were also given, having reference chiefly to the water-bearing properties of the rocks at Farina, Redhill, Blackrock Plains, and Yarcowie; also to certain stratigraphical phenomena at Farina, Beltana, and Burra.

ORDINARY MEETING, SEPTEMBER 5, 1882.

His Honor Chief Justice WAY, President, in the chair.

Donations to the Library since last meeting were laid upon the table.

Messrs. R. A. White, Superintendent of Signals, Railway Department, and Leonard William Haacke, Ph.D., Curator of the South Australian Museum, were elected as Fellows.

Mr. Charles Todd exhibited Campbell's sunshine recorder, which has been used at the Observatory for some time. The duration of the sunshine was, he need hardly point out, an important factor in climatology. The instrument was simple in construction, but its records were very valuable. It was one of the many means by which philosophers made Nature record her own operations. It consisted of a sphere of glass four inches in diameter, and a card being introduced in the focus of the parallel rays, the image of the sun falling upon the card burnt its track upon the card, which was graduated. He explained, by means of the blackboard, the principle of the sunshine recorder. In answer to a remark of Professor Tate, Mr. Todd said it would be a great advantage if a system could be devised whereby not only the particular portion of the sky overcast, but the density of the clouds themselves could be recorded. The effect of a dense cloud, of course, would have a greater effect than a thin cirrhus cloud.

Professor TATE drew attention to some mineral specimens from Eudunda sent by Mr. E. Bayer. They consisted of carbonate of iron and brown oxide of iron. There was nothing particularly remarkable about the specimens.

Baron Sir F. von Mueller's paper on a "New Acanthaceous Plant from Arnheim Land," was taken as read.

Dr. JAMES MANN, M.D., Medical Officer of the Destitute Poor Department, read a paper entitled "Notes upon the Life History of a Human Blood-worm." He gave a technical description of the worm, which is known to science as the *Filaria sanguinis hominis*, and he related the result of his observations in China, where the natives were infested by the worm. The mature filaria was very thin, but measured two or three inches long, had a distinct alimentary canal, and reproductive ap-

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paratus. After being discharged from the body of the mosquito the worm found its way into the stomach of the human subject through the water drunk. The parent selected as its habitat one of the lymph channels of man. Thence it discharged myriads of embryos, which found their way into the vessels which carried on the circulation of the blood. The embryos were incapable of further development, or of performing the functions of reproduction. They could only attain sexual maturity by the intervention of an intermediary host. That host was furnished by the mosquito, which dined on the blood of man. The embryos exhibited an extraordinary periodicity, being present from 7 p.m. till 7 a.m., and disappearing from the blood entirely during the day. No one knew where they went. That periodicity was influenced and modified by sleep. The filaria was very frequently associated with certain pathological conditions. Another peculiar characteristic was that if the patient slept in the day-time, and kept awake at night, the filaria appeared in the blood in the day, and not at night. Taken into the stomach the filaria might be acted upon by the gastric juice, but it sometimes succeeded in penetrating into the tissues, and had a peculiar aptitude for selecting the lymph tracts as its resting place.

There was a conversational discussion upon the subject of the paper, and the opinion was expressed that having mosquitoes here the filaria might also be found, but so far it had not been detected.

Dr. WHITTELL asked whether the parasite affected the Europeans as well as the natives. Dr. MANN said the Chinese drank water from the paddy-fields, and to that water mosquitoes had access, whereas Europeans were very careful to drink only filtered water. In answer to further questions, Dr. MANN said females predominated; the male worm had only recently been found. A portion of it was found in the neighbourhood of the groin-gland of a patient in Amoy, China, but the discovery was so recent that no further information had been obtained.

ANNUAL MEETING, OCTOBER 3, 1882.

His Honor Chief Justice WAY, President, in the chair.

The list of donations to the Library was read.

The annual report and balance-sheet were read. (See p. 121.)

The PRESIDENT, in moving the adoption of the report and balance-sheet, said that the former very clearly defined the operations of the Society. That evening he would retire from the Presidency of the Society. He had filled that position with pleasure to himself, but perhaps not to the Society. During

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the past two years it had been a source of gratification to him to attend the meetings of the Society, and he was indebted to the Science Director and to others for the very able and cordial support they had accorded him during his tenure of the position of President. And it was a source of gratification to him that the position he was about to vacate would be filled by a gentleman who well deserved the office. He alluded to their astronomer, Mr. Todd, C.M.G. (Applause.)

Professor TATE, in seconding the adoption of the report, said there was a great want in the direction of illustrating natural history specimens. He had been rendered valuable aid by the late Mr. C. H. Strother in that department. Mr. Strother, an able artist, had just got his hand in to the peculiar work when he died. The work was very difficult, and he was sorry to say that in Mr. Strother the Society had lost an aid most difficult to replace. He had illustrated some of the fossil lamp shells of South Australia, and his work had been spoken of highly. The volume to come should certainly be illustrated, and attention should be directed to the matter. The CHAIRMAN said the Government Printing Office now enjoyed facilities in the way of reproducing drawings in coloured lithography. If the Society applied to the Government they might allow the illustrations to be produced.

The report and balance-sheet were adopted, and ordered to be printed.

The following officers were elected for the ensuing year:—President, Mr. C. Todd, C.M.G.; Vice-Presidents, Dr. Whittell and Mr. D. B. Adamson; Hon. Treasurer, Mr. Smeaton; Hon. Secretary, Dr. Cleland; Council, Dr. Haacke, Dr. Stirling, Mr. Rutt, and Professor Tate.

In reference to the retirement of Mr. Rutt from the post of Hon. Secretary, the CHIEF JUSTICE expressed regret at the loss of his services.

On the motion of Mr. TODD, a vote of thanks to the Fellows retiring from the Council—the Hon. S. J. Way, C.J., Mr. Chapple, and Dr. Mayo—was carried.

Mr. TODD attributed to the interest taken in the Society's operations its success during the past year. Dr. Mayo and Mr. Chapple, retiring from the Council, had rendered valuable service. In reference to Professor Tate, who was the first President of the Royal Society of South Australia, he spoke in high terms of that gentleman's ability, zeal, and energy. Mr. Todd then thanked the Society for electing him President.

The CHIEF JUSTICE returned thanks, and said it had been his intention to read a paper, but his time had been unusually occupied during the year, especially with regard to two offices he held. He had therefore been glad to find that his friend Dr.

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Thomas, who for some time past had been devoting great attention to the subject, was prepared to read a paper on the "Statistics of Hydatid Disease in Australia." And the present was an appropriate time for the doctor's researches to be made public.

Mr. SMEATON reported that the amount subscribed towards the Darwin Memorial Fund was £16 16s., but other persons had promised.

ALTERATION OF THE RULES.

An alteration in the rules making the hour of meeting 8 p.m. instead of 7.30 was confirmed.

Mr. F. S. CRAWFORD gave notice of motion that the Council make arrangements for interim and informal meetings of members.

Mr. C. TODD made some reference to the comet appearing in the eastern heavens. He had watched it very carefully. It occupied a very sparse star part of the heavens, and was a grand object, occupying a part of the sky with no rival. He saw it on Saturday morning, and it was then rapidly approaching the sun, and the following Sunday it had passed its perihelion. It was so bright that it could be seen at noonday. Mr. Russell and Mr. Ellery had secured its meridian position. Since it had passed its perihelion it had retraced its path amongst the stars, and was now receding from the sun, and as it receded its tail increased very rapidly. It had increased from fourteen degrees to twenty. As the tail grew the nucleus became smaller, and it seemed as if passing from the head into the tail. He produced a drawing of the appearance of the comet as seen on Tuesday morning. It was reduced to a very bright streak, and looked like a ring fore-shortened. It was not unlike the comet of 1842 in some respects.

Mr. TODD also mentioned that steps were being taken to determine the longitude of South Australia, and the English astronomers had selected Lieutenant Darwin to visit Australia in connection with the work, and Mr. Stone had written that Lieutenant Darwin would observe the transit of Venus next December in Queensland, after which he would proceed to Banjoewangie and Singapore, there to exchange signals with an Australian observer at Port Darwin. It had been desired that he (Mr. Todd) should go to Port Darwin to make observations, but he could not leave.

EXHIBITS.—Specimens of *Pterostylis pedunculata*, an orchid new for South Australia, collected at Clarendon by Mr. O. Tepper, and in abundance at Battunga, near Echunga, by Prof. Tate.

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The following papers were read:—

"Supplementary Notes on Hypoxis pusilla," by Professor R. Tate.

"A List of the recent Echinoidea of South Australia," by the same.

"Additions to the Flora of South Australia," and a "Diagnosis of a New Rhamnaceous plant," by Baron F. von Mueller and Prof. Tate.

"On Hydatid Disease in Australia," by Dr. J. Davies Thomas.

This paper was introductory to one in preparation by the author on the "Statistics of Hydatid Disease in Australia," and its publication is consequently postponed. On the blackboard, and with the aid of diagrams, he explained the nature of the hydatid's operations. He pointed out the nature of the ravages the parasite could commit in the human system, and referred to the researches and experiments made by scientists resulting in remarkable discoveries calculated to prove beneficial to man. He expressed a hope that, seeing the spread of hydatid disease in Australia, some competent persons should make most careful experiments, with a view to doing away with any errors that might exist. Next to Iceland, Australia showed more hydatid disease than any other place in the world. He had experimented upon thirteen dogs, and six out of the thirteen were infested with *Tenia echinoccus*. Considering that many contain immense numbers of eggs, it was something alarming. The tapeworm was twice as common among dogs in Australia as in Iceland. The minute eggs of the pest were, no doubt, taken into the human system through water drunk. Sheep and oxen took in the minute ova with herbage or water, and the seeds of the disease were sown. The gastric juice softened the eggshell, and the movements of the stomach broke the shell, releasing the embryo, which immediately bored its way into the walls of the stomach. Very soon it met with a blood-vessel, and thus found its way to the liver, where it obtained a congenial location, and developed into a hydatid. In concluding his paper the doctor intimated that on another occasion he would enlarge upon the subject, and would give the statistics.

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Report of the Council

OF THE

Royal Society of South Australia

FOR THE YEAR ENDING SEPTEMBER 30TH, 1882.

In laying before the Society their report upon the work done during the past year, the Council feel that the numerous papers read at the ordinary meetings justify them in the hope that the forthcoming volume of the Society's Transactions will be fully equal in interest to its predecessors.

The Society has continued to receive through the Natural Science Director many specimens for exhibition and identification, and a good deal of information about the natural history of the province. The corresponding members and local correspondents are encouraged in their researches by the aid given to them in the identification of their specimens, and the assurance that all that is of value in their observations will be placed on record in the Society's Transactions. More than two years ago the Society commenced the systematic registration of the strata traversed by wells and borings, but the number thus recorded has hitherto borne a very small ratio to what might have been tabulated. The Hon. Commissioners of Public Works and of Crown Lands at the time kindly acceded to the request of the Council that all information obtained from Government sinkings should be forwarded to the Society, and printed forms were supplied to the heads of Departments for the purpose. Particulars of several borings have been received from the Hydraulic Engineer and the Engineer-in-Chief, but none of the numerous wells sunk by the Surveyor-General's Department in the outlying districts. This is to be regretted, as such information would be especially valuable. Fellows and local correspondents would render great assistance in this work if they would inform the Secretary of any wells about to be sunk either by local authorities or by private persons, in order that blank forms might be forwarded to the proper parties, and correct records obtained.

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The attention of the Society having been drawn to the difficulty and expense of obtaining correct analyses of mineralogical specimens, a resolution was passed affirming the desirableness of the appointment of a public analyst, and was forwarded to the Board of Governors of the South Australian Institute and to the Council of the University, who had the same question under consideration, but up to the present time the want remains unsupplied.

The membership of the Society has increased during the year from 102 to 123, of all classes, the increase being almost entirely in the class of Fellows, thus showing an increased interest in the work carried on. Two Fellows—Mr. R. Ingleby, Q.C., Mr. C. H. Strother—have been removed by death. Mr. Ingleby's connection with the Society dated from the year 1861, and his active interest in its proceedings continued unabated until failing health compelled him to withdraw from attendance at its meetings.

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THE TREASURER IN ACCOUNT WITH THE ROYAL SOCIETY OF SOUTH AUSTRALIA.

Dr.	£	s.	d.
To Balance, Oct. 1881	173	7	0
Subscriptions	74	16	0
Government Grant		13	0
Sale of Transactions	0	12	0
	£343	8	0

Cr.	£	s.	d
By Cost of Transactions	80	3	0
Assistant Secretary's Salary and Collector's Commission	21	12	0
Advertising and Printing..	21	1	10
S.A. Institute for Rent	12	0	0
Furniture	4	14	0
Postages and small Stationery	2	6	9
Balance in Bank	201	10	5
	£343	8	0

Audited and found correct,

E. PARISS NESBIT, Auditor.

3rd October, 1882.

THOMAS. D. SMEATON, Treasurer.

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LIST OF FELLOWS, MEMBERS, &c.,

NOVEMBER 7, 1882.

Those marked (F) were present at the first meeting when the Society was founded. Those marked (L) are Life Fellows. Those marked with an asterisk have contributed papers.

		Date of Election.
HONORARY FELLOWS.		
Angas, Geo. French, F.L.S., C.M.Z.S.,	Norland-square, London ..	1879
Barkely, Sir Henry, G.C.M.G., K.C.B.,	Royal Colonial Institute, London	1857
Ellery, R. L. J., F.R.S.	Observatory, Melbourne ..	1876
*Garran, A., L.L.D.	Sydney	1853
*Hull, H. M.	Hobart Town	1855
Jervois, H. E. Sir W. F. D., G.C.M.G., C.B.	Government House ..	1878
Little, E.	.. .. ..	1855
Macleay, W., F.L.S.	Sydney	1878
*Mueller, Baron F. von., K.C.M.G., F.R.S., &c.	South Melbourne	1879
Russell, H. C., B.A., F.R.A.S. ..	Observatory, Sydney ..	1876
Warburton, Col. P. Egerton ..	Beaumont	1858
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TRANSACTIONS AND PROCEEDINGS

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OF THE

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VOL. VI.

(FOR 1882-83.)

ISSUED DECEMBER, 1883.

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Hydatid Disease in Australia.

By J. Davies Thomas, M.D., London.

[Read October 3, and November 7, 1882.]

[abridged.]

The Royal Society has on several occasions shown an interest in questions respecting the common weal and health, and has, I feel sure, contributed to no small degree in educating the public on some matters closely connected with general hygiene. I therefore venture to think that any communication which has for its object the prevention of disease, pain, and death will meet with lenient criticism and friendly reception from the members of this Society.

Apart from the importance of the hydatid as a cause of disease in man and stock, its study is of great interest from a purely scientific point of view; so that any hesitancy I may feel is not because the subject is bald of interest, but rather lest the writer may prove unequal to his theme.

In dealing with hydatids, there are two points of view from which the subject may be regarded. Thus we may consider it merely from a biological standpoint, and study the parasite itself, its mode of origin, growth, and death, in the various phases of its life-history; or we may consider it from a medical aspect, as causing a disease often great in its painfulness and terrible in its danger to man and beast.

In connection with this latter view we might further discuss (1) the mode of its prevention, and (2) the best mode of treatment when it is present. The subject will, however, be presented to your notice only as a brief summary of what I have been able to learn about the prevalence of hydatid disease in man, and chiefly as concerns the Southern Hemisphere; and I shall also endeavour to point out how the risk of infection may be reduced to more moderate limits. On our way we shall see that there are many points upon which more information is needed, and in the investigation of which some members of this Society may do good service to science and to public health.

Dr. Thomas then gave an exhaustive account of the natural history of Echinococcus, as far as present knowledge of the

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subject permits, and briefly summarised the matter as follows:—

What is known as the hydatid cyst is really the cystic or bladder-worm phase of development of a minute tapeworm which inhabits the upper part of the small intestine of the dog. Three varieties of the hydatid have been described, viz., the Acephalocystic form, where no scolices or daughter-cysts are found; the variety called Echinococcus Scoliciparíens, where brood-capsules and scolices are present; and finally, Echinococcus Altriciparíens, where daughter-cysts are developed. There are good reasons, however, for the opinion that these forms do not mark distinct species, but merely variations of one species. I may remind you also of the remarkable transmutations and transmigrations undergone during the complete life-cycle of this parasite; how the adult tapeworm inhabits in great numbers the small intestine of the dog, but in which animal the hydatid cyst has never been found; that the last joint filled with ripe ova passes from the intestine of the dog into the outer world, and that the eggs are conveyed by the various external forces of nature into drinking water, and that they are scattered on grass and herbage; that the egg becomes swallowed by some herbivorous animal or by man, and that then the egg-shell becomes digested in the stomach, thus releasing the six-hooked boring embryo formerly enclosed within it. That the embryo begins at once to bore its way into the coats of the stomach until it reaches the inside of a small blood vessel, where it is caught in the current of blood, and conveyed to the capillaries of the portal system within the liver; here the majority rest and develope into hydatids. Some of them, however, pass through the capillaries of the liver and enter the general and pulmonary circulation. In this way it follows that any organ of the body may become the resting place of an embryo, which proceeds to continue its development into a hydatid. We shall find from the statistics of the disease that the lungs, heart, brain, spleen, kidney, muscles, and bones are all liable to be attacked, although by no means in a like proportion. The six-hooked embryo then proceeds to change into a hydatid cyst. This in turn produces by a process of budding the Echinococci. The Echinococci when transplanted into the small intestine of the dog develope into the Scolices. These now form joints, two or three in number, and the last one of these contains the ripe eggs. To such curious series of changes Steenstrup gave the name of the "alternation of generations." In sheep and oxen the cystic form of the parasite exists in the liver, lung, and other organs; but they never have the little tapeworm in the bowel. The hydatid lives, not on chyme, as the tapeworm does in the intestine of the dog,

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but on fluids secreted by itself from the blood of its host. It is extremely important to remember that sheep and oxen get the hydatid, and the dog the tapeworm. No one has ever seen this rule reversed in the case of Echinococcus. Man, in his relation to Echinococcus, resembles the sheep and ox, and not the dog, for he gets the hydatid cyst, but not the little tapeworm. The great practical fact is this:—That if there were no dogs we should not get hydatid disease. Eating underdone mutton or beef can never give us hydatids, though it might give us certain kinds of tapeworms. The dog, however, would not get Tænia Echinococcus if it did not swallow living scolices from hydatid cysts. Now, if all this be correct, we can see that the existence of a great many dogs, sheep, oxen, pigs, &c., in a country produce favourable conditions for the propagation of hydatid disease in man, for the greater the number of dogs the greater the number of hosts for the tapeworm form, and in like manner the greater the number of sheep, &c., the greater the number of hosts for the cystic form. There are four chief factors which determine the spread of hydatid disease in any country:—1. The number of dogs in the country. 2. The opportunities that exist for enabling the eggs, bred in the dog, to be swallowed by the sheep. 3. The number of sheep, oxen, pigs, &c. 4. The frequency with which dogs eat the organs of infected sheep containing living hydatids. Take a country with many sheep, the organs of which are often eaten raw by dogs, let the water supply be scanty and procured from bogs, swamps, waterholes, and dams, on the banks of which dogs may deposit the eggs, to be blown in by the winds, and washed in by the rain; let there be dogs in abundance, and we then have all the conditions necessary to the spread of the disease.

The Geographical Distribution of Hydatid Disease.

This disease is known to occur with greater or less frequency in all countries inhabited by Europeans or their immediate descendants. From Great Britain to America, from Denmark to Bengal, from Iceland in the north to New Zealand in the south, may this ubiquitous parasite be found. It would be safe, I think, to assert that wherever man and his faithful companion and servant, the dog, are found together, there will be found, with greater or less frequency, hydatid disease in the former. But the frequency of the disease varies greatly in different countries, and I shall give you as briefly as I can, the facts bearing upon this point, at least as far as I have been able to ascertain them. More particularly, I shall bring before your notice, figures illustrating the frequency of the

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disease in Australia. As British subjects, we naturally ask, in the first place, how often this disease occurs in our ancestral home.

Hydatid Disease in Great Britain.—When I entered upon the investigation of this question it seemed to me that there were two sources from which some reliable information might be gleaned, viz.:—1st, the Annual Mortality Returns of the Registrar-General of Births, Deaths, and Marriages; and 2nd, the annual records of the various hospitals. From the former source we might expect to learn how many persons die every year in Great Britain from hydatid disease, and from the latter how many patients come under treatment from this cause in the various hospitals. I regret to state that the amount of information from either source that I have as yet succeeded in acquiring is by no means so extensive as I could wish, for I have had at my disposal a few only of the Annual Reports of the Registrar-General of Births, Deaths, and Marriages for England and Wales, and I have been unable to learn anything about Scotland and Ireland.

Through the kindness of Mr. Cleland, the obliging Registrar-General for South Australia, I have been able to examine the annual reports of the Registrar-General for England and Wales for the decade 1871 to 1881. During these ten years there died in England and Wales—Males, 2,679,416; females, 2,498,895; total, 5,178,311. Of these 436 persons were reported to have died of hydatid disease, being at the rate of one out of every 11,876 deaths. Now, I think with Dr. Cobbold, that this return is very far below the true one, for many cases of hydatid disease, fatal and otherwise, are no doubt not recognised as such. However, we must for the present accept the figures as they stand. In round numbers, then, we must assume that about one death out of every 12,000 in England and Wales for the decade 1871 to 1881 was due to hydatid disease.

And now what do the hospital records teach us? About three years ago I forwarded to the authorities of a large number of London and provincial hospitals printed forms seeking information upon this point. Out of several dozens of such appeals, only two received any attention, for replies reached me only from the London Hospital and the Bristol Royal Infirmary. However, I have attained access in another way to the statistics of St. Bartholomew's Hospital for the decade 1869 to 1879, and to those of St. Thomas' Hospital for the four years 1876 to 1880. The return of the London Hospital extends over the five years, 1876 to 1881; that for the Bristol Royal Infirmary includes only the year 1880. However,

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by throwing together the returns of those four hospitals we get an idea of twenty years of hospital work in Great Britain, and they show that in all 110 cases of hydatids were under treatment. During the same period there were about 99,000 in-patients, medical and surgical, treated, so that about one case out of every 900 treated in these institutions during the periods in question was one of hydatids. As far, then, as the data at our disposal extend, we may conclude that about one death out of every 12,000 in England and Wales during the decade 1871-81 was due to hydatids, and that about one out of every 900 in-patients of the four hospitals mentioned was a case of hydatids.

GERMANY, FRANCE, ITALY, AUSTRIA, AND RUSSIA.—As far as I have been able to ascertain no data exist to show the prevalence of hydatids in these countries. However, the occurrence of the parasite in France, Germany, and Italy is certain.

HYDATID DISEASE IN ICELAND.—This country holds the unenviable position of being the one most highly infested with Echinococcus disease, and it may be instructive to devote some attention to the matter. It appears certain that hydatid disease has been just as prevalent in Iceland for centuries past as it is at the present time, for the earliest medical records of the country contain references to the prevalence of an affection of the liver, which could have been nothing other than this parasitic disease. Up to the present time an exact estimate of the frequency of the disease cannot be given, for the medical men resident in the country do not agree as to the proportion of the population attacked. Then, a great many persons have hydatids, and yet die of some other complaint; moreover, *post-mortem* examinations are made comparatively rarely; and, lastly, many of the victims of the disease recover by the efforts of unaided nature. However, many good authorities believe that from one-fifth to one-seventh of the entire population of Iceland suffers from hydatid disease. Other medical observers regard this estimate as too high, and consider that from one-fiftieth to one-sixtieth would be a more correct calculation. On the whole it seems to me that the balance of evidence points in the direction of the higher rather than of the lower figures. The Danish Government was so impressed with the gravity and extent of the evil that in 1863 it deputed a distinguished helminthologist, M. Krabbe, to investigate and report upon this question, and the result of his inquiries appeared in a treatise published in 1866, written, fortunately for us, in French, and not in Danish. He points out that the prevalence of hydatids

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in man is in correlation to the frequency with which sheep and oxen suffer from the same disease, and, above all, in correspondence with the very common presence of the adult tapeworm in the dogs of Iceland. In Iceland, at the time of Krabbe's report, there were for every 100 inhabitants 488 sheep and 36 horned cattle; pigs, however, were scarce. Now, the proportion of sheep and cattle per 100 inhabitants in Great Britain, according to Mulhall's balance-sheet of the world, 1870 to 1880, is—sheep 93, cows 29. So that if we include under the common title of "domestic herbivora" sheep and horned cattle, we shall see that in Great Britain, per 100 persons, there were of domestic herbivora 122; in Iceland, 524. Tersely, then, in Iceland there are per head of human population more than four times as many possible hosts for hydatids as there are in Great Britain. Now, as regards the possible hosts of the tapeworm, *i.e.*, the dogs. According to Krabbe there was in Great Britain in 1855 about one dog to every 50 inhabitants. In Iceland, at the time of his investigation, about one dog to every three to five inhabitants, *i.e.*, there were, at his lowest computation, ten times as many dogs per head of population in Iceland as in Great Britain. From this it follows, other things being equal, that an Icelander was threatened with hydatid infection from the dogs ten times more than an Englishman, and, besides that, every Icelandic dog had four times as many chances of eating the host of an hydatid as an English dog. But there are two other very important points to consider, viz., the opportunities that the dogs have of eating hydatids, and the chances of a man swallowing the eggs of the tapeworm. Of course the number of domestic herbivora and of dogs form only two elements in the chain of causation of hydatid disease. The most important elements by far are the numbers of these animals infested with the parasite, and the chances of mutual infection of the dogs and domestic herbivora. And, first, how many sheep, for example, are there affected with hydatids in the two countries? As regards Great Britain I have no data, but as concerns Iceland we have some facts, and in this connection I cannot do better than quote the following statement by Dr. J. Hjaltelin, who for many years was the chief medical officer for Iceland. He writes:—"I have for many years been investigating how frequent this disease is in the Icelandic sheep, and I have come to the conclusion that traces of it are found in more than every fifth sheep; nearly all the peasants have ascertained that this parasite may be found in every third sheep that is more than three years old. In a district called Skaptar-Syssel, with about 3,000 inhabitants and 22,000 sheep, the Echinococci are said to be found in every adult sheep, and it is worth attention

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that just in this district every third adult person is said to have hydatids. Whether this is exact or not I cannot tell, but thus it was stated to me by a physician who has been serving there for more than thirty years." So much for the prevalence of hydatids in the chief domestic herbivora of that country; and now let us turn our attention to the dogs of Iceland. Krabbe examined 100 Icelandic dogs, and found that in 28 of these Tænia Echinococcus was present, often in vast numbers. In Copenhagen he examined 500 dogs, but found this worm present in only two instances. Thus Tænia Echinococcus is seventy times as common in Icelandic dogs as in those of Copenhagen. According to Cobbold, who is the first authority on helminthology in Great Britain, Tænia Echinococcus has never been found present in any English dogs which had not previously been fed experimentally upon hydatids. This quite corresponds with the comparatively rare occurrence of hydatid disease in England. Then it must be remembered that in a country where sheep are so numerous, the dogs enjoy innumerable opportunities of eating the livers and lungs of sheep affected with Echinococcus, and thus they come to harbour vast numbers of the little tapeworms. And now as regards the last link in the chain of causation of hydatids, viz., the swallowing by man of the eggs of the tapeworms. All travellers whose works on Iceland I have read draw special and frequent attention to the gross uncleanliness of the people. Sheep, cows, and dogs live under the same roof as the family during the long weary months of Iceland's bitter winter. The houses are devoid of ventilation, and almost entirely of light. The configuration of the country is such that extensive bogs and swamps alternate with lofty mountains, large rivers, and numerous lakes of all dimensions. The bogs and swamps are just the most suitable receptacles for the eggs of the tapeworm, deposited in myriads on the long matted grass, or more solid hummocks that often stud the area of the swamps. Then, owing to the diet of the people being largely composed of stock-fish, scurvy is common, and raw vegetables are a delicacy and greedily consumed, thus giving another agent for the conveyance of the ova into the body. No doubt the three chief media are the bog and swamp-water used for drinking purposes; the consumption of raw vegetables, upon which the eggs have been deposited; and the habit of allowing dogs to cleanse the plates by licking them. Even the stock-fish that constitutes the staple article of diet is heedlessly piled on the filthy floor of the dwelling-house, ready to become befouled by the dogs. The prevalence of the disease among the sheep is explicable in like manner by the swamp-water drunk, and the grass eaten by them. "The only land cultivated in Iceland is

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the *tun*, which is a meadow surrounding the house, varying in extent according to the number of cows kept on the farm. This field is dressed with their dung, and produces the hay which constitutes the food of the cattle during the winter" (Baring Gould, p. 45). It is evident how easily the grass and hay of this small meadow may become infested with the minute ova of the innumerable Tænia harboured by the numerous dogs of an Icelandic homestead.

Hydatid Disease in the Australasian Colonies.

I think that most of the intelligent public of Australia have known or heard that hydatid disease is a common one in this Southern Britain, but hitherto no extensive investigation into the prevalence and causes of this disease has been undertaken in Australia. Now, as this malady is, theoretically at least, perfectly preventible, and as moreover it may, I believe, be practically reduced in extent, I think that the entire subject is worthy of careful study and close investigation. Of course the first step in any such inquiry is to ascertain as far as possible the extent and local distribution of the disease; and in the case of Australia, as in that of Great Britain, we may hope to get reliable data from—1st. The mortality returns of the various colonies; and, 2nd. The records of the hospital in each province. I mentioned my desire to the Hon. W. Morgan, who was Chief Secretary of South Australia at the time I commenced this work, and he most kindly offered to use his influence with the Governments of the other colonies to further my inquiry. I beg to offer my most cordial thanks, not only to Mr. Morgan, but also to the Hon. J. C. Bray, who has also greatly aided me. Through the kind influence of our two Chief Secretaries, I have also received the greatest assistance from Mr. Graham Berry and Sir Bryan O'Loughlen in Victoria, and from Sir Henry Parkes in New South Wales. Equally ready and courteous help has been given by the Governments of Queensland, New Zealand, and Tasmania. Not only have the Governments of all the colonies given their powerful and indeed indispensable aid, but the hospital officials and public registrars have ungrudgingly and carefully taken infinite pains to supply the facts required. I cannot too gratefully acknowledge my obligations to my fellow-workers in this cause, and can only earnestly hope that great public good will result from the publication of the facts supplied by them. I shall first draw your attention to the hydatid statistics of the various colonies, and then I shall endeavour to point out the causes of the striking prevalence of the disease in some of them. From all the colonies of Australasia replies to my questions have been received, but as might have been expected,

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the amount of information obtained is not equal in all cases. Thus I may dismiss Western Australia very briefly. In March, 1878, the Colonial Secretary wrote that he regretted his inability to supply information as to deaths from hydatid disease, because "under the Registration Act of this colony, it is not compulsory on individuals registering deaths to produce the certificate of a professional man; consequently, causes of death in most instances are recorded in general terms, and it would be impossible to render any return of the kind required, there being no reliable data at command." As regards Victoria, New South Wales, Queensland, South Australia, New Zealand, and Tasmania the case is different.

VICTORIA.—Before giving you the statistics of the province, I cannot refrain from expressing my admiration of the exhaustive character of the returns, and of the promptitude with which they were supplied. The details of official records in Victoria must be as near perfection as possible. In the first place, let me remind you that by the census taken in 1881 the population of Victoria amounted in round numbers to 862,000 souls, of whom rather more than one half were males. The mean annual mortality of the colony has lately been 13·5 per 1,000 inhabitants. And now as regards the number of deaths attributed to hydatid disease. From the Registrar-General's returns, it appears that during the twenty years, from the commencement of 1862 to the close of 1881, 584 persons died from hydatids. Of these there were of males, 338; of females, 246; total, 584; and during the fourteen years, 1868 to 1881, it appears that 2·98 per thousand of all the deaths in the province were caused by hydatids. I will not inflict upon you the details of the annual figures, but I wish to mention that upon the whole there has been during these twenty years a constant but somewhat irregular increase in the mortality from hydatids with advancing time. This is particularly conspicuous when we compare the four quinquennial periods embraced within the twenty years. Thus:—First quinquennium, 1862 to 1867, 59 cases; second do., 1867 to 1872, 112 cases; third do., 1872 to 1877, 182 cases; fourth do., 1877 to 1882, 231 cases; total, 584 cases. This steady and gradual increase is evidently due to one or both of two causes, viz., either hydatid disease is becoming more prevalent in Victoria, or the Registrar-General is being more accurately informed as to the true causes of death. But of course it must be borne in mind that the population of Victoria has increased greatly during these twenty years. Thus:—Population of Victoria, 1862, 554,358 souls; do., 1882, 862,346 souls. But then, in the last quinquennium there were nearly four times as many deaths from hydatids as in the first quinquennium, whilst the population was

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not nearly twice as great—probably only about half as much again. As regards the ages of the victims, no age was exempt—the child, the adult, the old, all succumbed to this parasite. Thus:—Under 10 years of age there were 36 deaths; from 10 to 20, 57 do.; from 20 to 30, 89 do.; from 30 to 40, 100 do.; from 40 to 50, 109 do.; from 50 to 60, 73 do.; over 60 years of age, 32 do.; ages not stated, 4 do.; total, 500 deaths. These numbers include the deaths in the fourteen years, 1868 to 1882. I have not the data as regards age prior to 1868. From these figures it will be seen that the number of deaths increases steadily with advancing age up to 50. Afterwards the numbers diminish. This is not because people are less liable to hydatids after fifty, but because the greater proportion of people die before reaching that age. Now as regards the data supplied by the hospital records of Victoria, I have received returns from the following hospitals:—Alexandra, Alfred, Ballarat, Beechworth, Belfast, Castlemaine, Clunes, Creswick, Daylesford, Dunolly, Geelong, Heathcote, Horsham, Inglewood, Kilmore, Kyneton, Maldon, Mansfield, Maryborough, Melbourne, Pleasant Creek, Portland, St. Arnaud, Sale, Sandhurst, Swan Hill, Wangaratta, Warrnambool, Woods Point. I need not trouble you with the details of these returns, but I shall pick out those facts only which are of general interest. In some of these institutions no cases of this disease were recorded in the books. This was the case at the Belfast, Maldon, Mansfield, Swan Hill, and Warrnambool Hospitals. In the remaining hospitals, however, no fewer than 1,001 cases had been treated. Of these, the result was unknown in 373. In 206 instances death was known to have resulted, so that we can reckon the mortality of hydatid disease even under the best available treatment as at least 20 per cent., and personally I am convinced that this is much below the real figure, for many cases are discharged from hospitals, and leave the care of their medical advisers, which are apparently cured, and yet come back in a few months or years worse than ever. Now taking the lowest estimate—*i.e.*, 20 per cent.—as fatal, and remembering that the Registrar-General's report for 20 years gave 584 deaths from this disease, it follows that in Victoria there were about 3,000 cases of hydatids during the 20 years 1861 to 1882. I think that this estimate of preventible disease is sufficiently startling, and not only justifies, but urgently invites, inquiry. And yet one case of smallpox would receive more attention than these 3,000 sufferers have done—at any rate, at the hands of the official guardians of the public health. As regards the proportion in which the two sexes were attacked, some information may be given:—Sex not stated, 171 cases; males, 493; females, 337; total, 1,001.

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There was thus a preponderance of cases in males, but as there has been a considerably larger number of males than females in Victoria until quite lately, there cannot be much importance attached to the disparity of sexes attacked by hydatids. The proportion in which the different organs of the body were attacked was very interesting, but as I shall consider this point in connection with the total number of cases occurring in all the colonies, I need not discuss it here. It is important to notice that if we take the hospitals of Victoria as a whole, there was about one case out of every 175 of the total indoor patients treated suffering from hydatid disease. I may remind you that in the four English hospitals the proportion was one hydatid out of about every 900 patients, so that it appears that hydatid disease is more than five times as common in Victorian as in the four English hospitals. But the different hospitals of Victoria itself did not show a like proportion of cases. Thus no cases at all, as I have already stated, were recorded in the Belfast, Maldon, Mansfield, Portland, Swan Hill, and Warrnambool Hospitals, and yet between them they had 5,639 in-patients during the periods over which their returns extended.

South Australia.—According to the census taken in April, 1881, the total population amounted to 279,865 — males, 149,530; females, 130,335. The death-rate in 1881 was 13·90 per 1,000. The Registrar-General's returns of hydatid deaths, for which I am indebted to the kindness of J. F. Cleland, Esq., extend over the 16 years from 1866 to 1881. In six of these years, viz., 1866-70 and 72, no deaths were returned as due to hydatids. In 1871 there was returned 1 death; in 1873 there were 3 deaths; 1874, 1; 1875, 2; 1876 and 1877, together, 11; 1878-79, 3; 1880-81, 13; total, 34. So that for all the 16 years in question there were only 34 deaths attributed to this parasite. Now, if we take the last ten years, *i.e.*, from 1872 to 1881 inclusive, we find that there were 33 deaths from hydatids out of a total of 34,431 deaths (Statistical Register for 1881, page 25) occuring during the same period; so that hydatid disease is credited with having caused about one death out of every 1,043 during the last ten years. I am inclined to think that this is considerably below the number of deaths that actually occurred from this parasite. And now as regards the data supplied by the records of the various hospitals in the province. Of such institutions there are nine, viz., the Adelaide, Mount Gambier, Port Adelaide, Port Augusta, Port Lincoln, Wallaroo, Kapunda, Blinman, and Burra Hospitals. Of these the only ones which are large enough to supply any information on this subject are the two first named. I am indebted to Mr. E. H. Hallack for the very exhaustive returns of the Adelaide Hospital, which extend over a period

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of 30 years, viz., 1852 to 1882. During this time 158 cases of hydatids were recognised and treated. There were in all under treatment as in-patients 36,556 persons, so that about one case of every 245—exactly 244·68—in-patients was hydatids. As regards the results of the treatment, we find that in 13 cases the results were not given; of the remaining 145, 20 died whilst in hospital, being at the rate of 12·66 per cent.

The Mount Gambier Hospital.—I have to thank Dr. Jackson, lately Assistant Colonial Surgeon, for the statistics of this hospital during the seven years 1873 to 1880, and they are very significant. During these seven years 36 cases of hydatid disease were under treatment. During the same period there were of in-patients 1,905. So that no less than one case out of every 52·9 was hydatid disease. I am convinced that out of Iceland no place in the known world is so badly infested with this parasite as the South-Eastern district of this colony, which supplies the majority of the inmates of the Mount Gambier hospital. As I shall revert to this point afterwards, I need not discuss it here. In order to strike an average for the hospitals of South Australia we must add together the results of the Adelaide and Mount Gambier Hospitals. This will show us that about one case out of 198 in-patients suffered from hydatids.

Queensland. — According to Hayter, the populatian of Queensland on December 31st, 1880, was 226,077 persons. The average death-rate for the decade 1869-79 was 17·27 per 1,000. It appears that the published statistics of this colony did not contain any particulars respecting deaths from hydatid disease prior to the year 1878, so that the only data at my disposal have extended over the four years 1878 to 1882, and during this time only five deaths from this cause were registered; so that only about one death out of 6,000 arose from hydatid disease in Queensland.

The Hospital Statistics of Queensland.—Returns were sent from the hospitals at Bowen, Ipswich, Springsure, Stanthorpe, Charters Towers, Towoomba, George Town, and Maryborough. In five of these no cases of hydatids had been met with, viz., Bowen, Charters Towers, George Town, Maryborough, and Springsure. As regards the Ipswich Hospital, the return comprises the 20 years 1860 to 1880. During this long period only two cases of hydatid disease were treated. The average number of in-patients is stated to be 300 per annum. The Stanthorpe Hospital's record extends over the five years 1875 to 1880. Four cases only were observed, and one of these was not a hospital case. In the Toowoomba Hospital books only one case of hydatids appears. Thus it will be seen that the data

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supplied from Queensland are too scanty to permit any numerical estimate to be made, but they show conclusively that the disease is comparatively rare in that colony.

TASMANIA.—The population on December 31st, 1880, was 114,762. The mean death-rate for the decade 1869-79 was 15·59 per 1,000. First, as regards the deaths registered as due to hydatid disease:—In March, 1878, the Colonial Secretary wrote that during the ten years immediately antecedent to 1878 "no deaths from this disease were registered." However, in 1878 there were two deaths, in 1879 two deaths, in 1880 one death, in 1881 one death; total, six deaths. So that in the last four years there have been six deaths from that cause. This was at the rate of ·871 per 1,000 deaths.

Hospitals of Tasmania.—Returns were received from the Hobart, Launceston, and Campbelltown Hospitals. There was no record of any case of this disease in either the Launceston or the Campbelltown Hospital. The returns of the Hobart Hospital comprise the four years 1878 to 1881 inclusive. There were thirteen cases treated suffering from hydatids. During the same period there were 4,223 in-patients, so that in the four years under our notice about one case out of 528 total in-patients was hydatid. As by some misunderstanding I have not been able to learn the total number of in-patients treated at the Campbelltown Hospital, I am unable to give the general hospital hydatid-rate for the colony, but I have reason to believe that not more than one out of every thousand cases treated is of this nature.

NEW ZEALAND.—Population on December 31st, 1880, 484,864 souls. Mean death-rate from 1869 to 1879, 12·17 per 1,000. The Acting Colonial Secretary, in a letter dated March 7th, 1878, states that the causes of death were not compiled by the Registrar-General's department prior to the year 1873. A statistical return that should have accompanied this letter has not reached my hands, so that the only returns in my possession are those for the four years 1878, 1879, 1880, and 1881, and they show that in the year 1878 the deaths from hydatids were six, equal to 1·29 per 1,000; in 1879, seven, equal to 1·25 per 1,000; in 1880, nine, equal to 1·65 per 1,000; in 1881, three, equal to 0·55 per 1,000; total, 25. So that 1·185 per 1,000 of the deaths that took place in these four years resulted from hydatid disease. In hospital returns for New Zealand replies were received from Auckland, Charlestown, Christchurch, Dunedin, Gisborne, Hokitika, Lawrence, Napier, Naseby, Nelson, New Plymouth, Oamaru, Picton, Reefton, Southland, Thames, Timaru, Wakatipa, Wellington, and Westport. In eleven of these no hydatids had been treated, viz., Charlestown,

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Gisborne, Lawrence, Napier, Naseby, Oamaru, Picton, Reefton, Southland, Thames, and Timaru. In the nine remaining hospitals there had been in all 57 cases of hydatids under treatment, and the proportion of cases of this disease to the total in-patients, as far as I could ascertain, was one out of every 745·7. I think that this estimate is rather too high, but it is based upon the statistics at my disposal. From both the Registrar-General's and the hospital returns it will be seen that hydatid disease is not very prevalent in New Zealand.

New South Wales.—According to Hayter's Year Book, the population of this province on December 31st, 1880, was 739,385 persons. No separate classification of hydatid disease was made by the Registrar-General's department prior to the year 1875. Since that date, however, I have, through the favour of the Government, been supplied with the annual returns of deaths due to this cause. I need not now enter into details, but merely give you the gross result for the seven years, 1875 to 1882. During this period 56 persons died from hydatids, viz., 29 males and 27 females. During the same period 75,563 persons died in this province, so that one death out of every 1,349·3 was caused by hydatid disease, being at the rate of ·741 per 1,000. From the hospital returns there appear to have been 103 cases of hydatids in all. From these we have to omit nine cases, as there are no corresponding returns of in-door patients. This will leave 94 cases out of a total of 35,760 in-door patients, being at the rate of one out of every 380 cases.

Summary.

From the returns of the departments of the various Registrars-General, we find that there died of hydatid disease:—

Name of Country.	Period over which Returns extend.	Rate of Mortality due to Hydatid Disease.
England and Wales..	1871 to 1881	1 out of about 12,000
Tasmania	1878 to 1882	·871 per 1,000
New Zealand.. ..	1878 to 1882	1·185 per 1,000
Queensland		
New South Wales ..	1875 to 1882	·741 per 1,000
South Australia ..	1866 to 1881	·94 (nearly) per 1,000
Victoria	1868 to 1882	2·98 per 1,000

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The following shows the proportion of the hospital in-patients suffering from hydatids:—Four English hospitals, about one out of 900; Victorian do., about one out of 175; New South Wales do., about one out of 380; South Australia, do., about one out of 245; Queensland do., returns inadequate; New Zealand do., about one out of 746; Tasmanian do., about one out of 325.

TABLE showing the number of domestic herbivora (including sheep and horned cattle) per 100 inhabitants in the following countries:—

Country.	Sheep.	Horned Cattle.	Domestic Herbivora.
Great Britain ..	93	29	122
France	64	30	94
Germany	55	35	90
Iceland	488	36	524
Europe	66	30	96
Victoria	1,204	149	1,353
New South Wales..	4,381	348	4,729
Queensland ..	3,067	1,398	4,465
South Australia ..	2,415	114	2,529
New Zealand ..	2,695	119	2,814
Tasmania	1,554	110	1,664

The numbers for Great Britain, France, Germany, and Europe as a whole are from "The Balance-sheet of the World, 1870-80," by Michael G. Mulhall, F.S.S.; London, Edward Stanford, 1881 (table 27, page 40). Those for Iceland are from Krabbe, "Recherches Helminthologiques en Danemark et en Islande," page 59. Those for the colonies of Australia are from Hayter's "Victorian Year-Book, 1880-81" (folding-sheet No. 3). When we come to consider the number of domestic herbivora in each colony, we find that in Victoria, where, according to our statistics, hydatid disease in man is most prevalent, the number of domestic herbivora per 100 inhabitants is the lowest. So that it is quite plain that other important elements must co-operate to cause hydatids in man; and this bears out my assertion that domestic herbivora do not directly infest man with Echinococcus disease, but merely suffer in common with him.

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TABLE showing proportion of registered dogs in Victoria to population:—

Year.	Population, according to Hayter.	Number of Dogs.	Proportion of Dogs to Population.
1872		32,504	
1873	772,039	33,284	1 to every 23
1874	783,274	34,191	1 " 23
1875	791,399	36,917	1 " 21
1876	801,717	36,532	1 " 22
1877	815,494	37,097	1 " 22
1878	827,439	37,251	1 " 22
1879	840,620	37,248	1 " 22½
1880	860,067	37,495	1 " 23

DISCUSSION.

Professor TATE said there was something incompatible in the existence of the disease in the South-East, with the large quantities of water there, and he would rather have expected that it would be found most frequently in the North, where the people for the most part got their water from dams, and towards the Wimmera District. He was also disposed to doubt the localization of the disease by the statistics which had been given, and was rather disposed to think that the reputation of Dr. Jackson, formerly of Mount Gambier Hospital, had something to do with the disproportionate number of cases that had been attributed to the South-East. In fact, he thought the Mount Gambier Hospital had drained large districts of Victoria of hydatid cases. Those acquainted with Mount Gambier knew that the water was always running underground and near the surface, so that it could not be permanently contaminated by dogs, and the water used for domestic purposes was for the most part obtained from wells, the swamp water being rarely used. Then the statistics showed that women and children died from this disease in about the same proportion as the men, who might be supposed to run greater danger on account of their vocations, clearly indicating that the disease was generated near the homes. For his own part he was disposed to think that the disease was largely communicated by means of the uncooked vegetables so generally used in salads. More evidence should be obtained on the point whether water was the chief means of conveying the Tænia Echinococcus into

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the intestines of the human subject, as the statistics available had so far failed to prove it. We wanted to know how the disease was contracted, and under what circumstances; how long the eggs would endure submergence in water, and whether they would float or sink; and what temperatures they would stand without losing their vitality? It was also desirable to ascertain if eggs deposited in a swamp, and subsequently blown about with the dust, when the swamp had dried up, would retain their vitality. These important inquiries into the secondary causes of hydatids could not be carried out effectually by private persons. It was a work that should be undertaken by Government, and it would not be out of place for the Society to suggest to the Government the advisableness of having such investigations undertaken, as these statistics showed that the disease was a growing one. Another question was — Could we deal with this difficulty from the dog point of view? Could we cure the dogs? If not, then all the dogs should be killed and cremated. The disease should be stamped out at all events, for it in a measure involved the life of the nation. Under these circumstances the Government would fail in their duty if they did not do something to deal effectively with this disease in its infancy.

Dr. PEEL NESBITT thought there was no doubt that the ova were ingested with uncooked vegetables, and this was probably the reason why the disease was so common in the neighbourhood of Mount Gambier, because it did not exist in the North, where the people drank water obtained from dams, and did not often get fresh vegetables to eat. He did not believe, however, that many patients suffering from hydatids came to Mount Gambier Hospital from Victoria, for although Dr. Jackson had a high reputation every effort was made to exclude Victorian patients He agreed that something should be done with the dogs if the disease was to be stamped out.

Mr. SMEATON suggested that it might be well to go further back—to the sheeps' livers with which the dogs were fed.

Mr. SMYTH was of opinion that some comparison should be instituted between the livers of the sheep in Adelaide and those of the sheep in the South-East, with the view of ascertaining why the latter contained more hydatids than the former. If the disease was communicated by means of uncooked vegetables it should be very prevalent in and around Adelaide.

Professor TATE asked Dr. Thomas if the water of the South-East had been examined, with a view of detecting any eggs of the Tænia, as this was one link in the chain of research which should be carried out.

Dr. THOMAS was of opinion that this had not been done.

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Dr. WHITTELL said there could be no doubt that this was a subject which was of the greatest importance to this colony, because if Dr. Thomas's papers proved anything they proved that hydatids were largely on the increase; that they were spreading from place to place, and that year by year a larger number of people died from them. After complimenting Dr. Thomas on his research, he expressed the opinion that the papers would do a great deal of good in dissipating some of the ignorance that existed amongst the people with respect to the causes and development of this disease. He had felt for some time that, although scientific men had done a great deal in investigating this subject, they had not quite succeeded in clearing up all the difficult points connected with hydatid disease as it affected man. Tænia Echinococcus, like all tapeworms, had to pass through two stages—first, as larva in the cysts, and then in a developed state after it had obtained entrance into the human subject. There was no doubt that there was a direct connection between the cyst in one animal and the tapeworm in another; and it was also certain that there were different kinds of tapeworms and different kinds of cysts which affected or preferred particular animals. In fact, it was possible from an examination of the cysts to predict the kind of tapeworm that would be produced, and to fix upon the kind of animal that bred it. They found, moreover, that there were certain larvæ in the cow, in the pig, in the sheep, in dogs, and in man which were called hydatids, and so far as they had been able to tell there was a great resemblance between the hydatids of the sheep and of man. Up to recent times these had distinct names, but closer observation had led scientific men to the opinion that the hydatids of the sheep and of man were identical —that they were both derived from Tænia Echinococcus. Personally he was satisfied of this identity, but it was only an assumption which might at some future time be overturned. He was strongly of opinion that this question should receive more attention than it had, and this was apparent when they remembered the evidence upon which scientific men had based their conclusion that hydatids came from the Tænia in the dog. Experiments in dogs had been generally successful in countries where Tænia were rare; but in this colony, where they were common, such experiments would not be so satisfactory. So far, however, failure had attended all experiments to convey hydatids taken from the human subject to dogs, and this was the weak link in the chain. It had not been demonstrated absolutely and positively that the Tænia was the cause of hydatids. He would suggest to Dr. Thomas the advisableness of experimenting in this direction, in order to get a satisfactory solution of the problem, and he believed that this end could be

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attained by an expenditure of time, money, patience, and some little personal risk. And this would be a great gain, because it was the question of questions in regard to the settlement of the origin of hydatid disease. He also thought that a large number of ova obtained from the Tænia in this colony should be sent to England for experiment in the same direction. He was afraid that he had made a mistake in saying "to England," because if a scientific man caused the same amount of pain to animals, with a view of discovering something that would tend to the saving of human life, as resulted from many so-called sports, he would stand a good chance of seeing the inside of one of Her Majesty's prisons. These ova should be sent to some place where the physiologist and biologist were not watched by the policeman while they were making their experiments. Physiology was not exactly dead in England, but it was seriously hindered in its investigations by the sentimentality of old women of both sexes. While he could bear testimony to the industry that had characterized Dr. Thomas in the collection of his statistics, he could not agree with some of the conclusions that he had drawn. A leading proposition in the paper was that there are four factors which regulated the spread of hydatid disease in any country—(1) the number of dogs in proportion to the population of the country; (2) the number of sheep and oxen in the country; (3) the opportunities that existed for the dogs to swallow the eggs bred in the sheep; (4) the frequency with which the dog devoured the organs of infected sheep containing hydatids. As far as Australia was concerned the two last factors would be equal in all the colonies, and the sheep in one colony would be just as liable to get the disease as any other, so that they were reduced to the other two factors. Although there was only one series of figures the conclusions suggested were different from those drawn by Dr. Thomas. In Victoria, the number of dogs during the seven years dealt with remained about stationary, viz., one dog to every twenty of the inhabitants, but the deaths from hydatids had enormously increased. From 1872 to 1877 the number of deaths was 960, but in the next five years they had increased to 1,150. Of course there had been some slight increase in the population, which should be taken into consideration; but that should not add more than three or four deaths to the number, but instead of that they had an annual average death-rate of 231 against 182. Then, as to the other factor, the statistics seemed to prove that the greater the number of sheep and oxen the less hydatids. New South Wales had the most stock, but was only fifth on the list of mortality from hydatid disease; while Victoria, with the least stock, had in proportion to her population the highest

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death-rate from hydatids. Queensland in stock came close behind New South Wales, and there hydatids were practically unknown, as only six cases of death from that cause had been reported. From these facts he was disposed to think that there was something wrong about Dr. Thomas's figures—there seemed to be a hidden factor somewhere, which had not yet been discovered, but he hoped that Dr. Thomas, during his forthcoming visit to the South-East, would be able to ascertain what it was. With regard to the number of cases of hydatids at Mount Gambier, he was inclined to think that the comparison had not been drawn correctly—that Dr. Thomas had overlooked one fact which vitiated a great part of the conclusion he had come to, that the South-East was, next to Iceland, the country most affected by hydatids. He had taken the experience of the Adelaide Hospital during the past thirty years, and the experience of the Mount Gambier Hospital for seven years, and this was hardly fair. The first death from hydatids in the Adelaide Hospital was reported in 1876, and it was only right to assume that the disease had not been known or made its appearance in Australia much before that time. A more equitable comparison would have been to take the results of seven years' experience at both hospitals, and if this were done he did not think that there would be so great a difference in the proportion of persons suffering from hydatid disease as Dr. Thomas's figures indicated. The practical question we had to deal with was how to arrest the ravages of this enemy, which was rapidly extending in all directions, and although it might be necessary to call on the Government to assist in the making the prolonged inquiries that were necessary, a great deal might be done by the agencies already available. Professar Tate had asked a question with regard to the vitality of the Tænia. He did not know that any evidence existed with regard to that, but Davaine had demonstrated the extreme vitality of the pig tapeworm. After the ova had been kept in water for over twelve months, they were found to be living and able to create disease in animals to whom it was administered. Other observers had ascertained that even after the worms had become rotten and mildewed, the eggs, when taken away and administered to animals, produced cystic disease. There was one satisfactory fact about the matter, however, and it was this—that all observers were agreed that after the eggs became dry they lost their vitality; and bearing this in mind it was easy to realise the vast amount of good done by our hot weather and winds. If there were the requisite determination, he was convinced that the disease could be stamped out in three or four months, because Tænia were not very long-lived parasites, and came to maturity and fulfilled all their functions in ten or thirteen

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weeks. If all those interested in the slaughter of sheep, oxen, pigs, and other animals, whenever they saw any indication of hydatids in their internal organs, cut out the affected parts and burned them the disease would be stamped out within four months. Of course there would be still those animals affected with the diseases; but as far as human beings were concerned, the doctors would cure some, the hydatids would kill some, and others again would outlive the hydatids. There was a want of knowledge how to deal with this matter all over the colony; the people were looking everywhere for means to escape from or cope with this disease, but they had looked in the wrong directions.

Dr. THOMAS, in reply to the criticisms and observations made on his papers, referred briefly to the various points involved in the discussion of such a subject, and expressed the opinion that Professor Tate had pointed out the direction in which inquiries should be made. While his statistics were not so complete as was desirable, he believed they were as complete as could be obtained in the colonies. He believed that the tapeworm and Tænia were conveyed into the dog by means of herbivorous animals, and that at least 40 per cent. of the stray dogs of the city were affected with this pest. In fact, the specimens of the Tænia which had been shown under the microscope had been taken from various dogs of that description. He suggested that pigs or other suitable animals should be obtained and inoculated, and kept for say twelve months, as by this means all the stages of the parasite from the larvæ to the secondary cysts might be ascertained. Even if his comparison had been restricted to a seven years' experience of the Adelaide and Mount Gambier Hospitals, he did not think that it would alter the fact that the South-East was the worst place after Iceland for hydatids. In referring to the four factors which, in his opinion, regulated the spread of hydatids, he never meant to say that the number of herbivorous animals or dogs decided this question, but that these factors must all work together in a co-ordinate strain. With regard to water being the main medium for the propagation of the disease, Dr. Jackson was distinctly of opinion, before the people of the South-East awoke to the fact, that their water was their poison, that they were very careless in their use of it. He intended to have the water of the district tested, not only shortly, but also later on in the season. He also intended, if possible, to ascertain what proportion of the sheep and cattle had the hydatid disease. Mr. Chalwin, the veterinary surgeon, had made the statement on good authority that *every* beast was affected, and as he thought the kangaroos also were very much affected with hydatids of the liver, of

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course, when the dogs killed them they too contracted the disease. With regard to the dogs, he was convinced that if he could not find 40 per cent. unaffected in Adelaide, the percentage diseased would be 60 or even more in the South-East.

SUPPLEMENT.

[Read March 6, 1883.]

[Dr. THOMAS, at a subsequent date, after a personal inspection of the South-Eastern portion of South Australia, the western district of Victoria, and the City of Melbourne, made the following additional remarks as the result of his observations:—]

As regards our colony, my investigations were principally made in two directions:—First, as to the alleged prevalence of hydatid disease in man and the lower animals in the South-East; and, secondly, as regards the occurrence of the adult tapeworm in the dogs there. Upon the first of these points the records of the Mount Gambier Hospital and the experience of the medical men practising in the various towns supplied me with valuable information, and I shall in the first place communicate that to you. From questions put to medical men practising at Kingston, Millicent, and Mount Gambier, I was informed that hydatids were extremely common in their several practices, and it appeared that the part of the country most liable to this disease was, roughly speaking, a triangular district, which was bounded on the north by the line of railway from Kingston to Narracoorte; on the east by a line drawn from Narracoorte to MacDonnell Bay; and on the west by the coast line. Of course it is not meant that this is the only infected part, but merely that in a rough-and-ready way this marks the worst part of the country. And it appears, too, that kangaroo and domestic animals suffer more from hydatids here than elsewhere. Of course during a brief sojourn in these parts it was impossible for me to authenticate these statements for myself, but I am quite willing to believe them. I must say, however, that at Benara Station, near Mount Gambier, where alone I had the opportunity of examining about half a dozen brush-kangaroos, I failed to find in any single instance any hydatids, either in the lungs or other viscera of the animals; and the same remark applies to eight brush-kangaroos examined on the opposite side of the Victorian frontier at the Punt. This, however, proves but little, for at the Punt there is an abundant supply of drinking water in the beautiful Glenelg River, and

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of course so large a water supply could never suffer serious contamination. I do not know whence the game on Benara obtain their drinking water. In order to arrive at any trustworthy data of this kind the water supply most accessible to the kangaroo should be noticed, and as this is being done in some parts of the South-East, I have no doubt that ere long we shall have some interesting facts to record. Dr. Jackson, whose opinions upon this subject must command the greatest respect, was of opinion that "the unusual prevalence of hydatid disease in the South-Eastern District may be fairly attributed to the large number of marsupials and (to a lesser extent) of native dogs or dingos which abound, and to the peculiar disposition of the water supply, most of which exists as surface-water or swamps." Dr. Jackson attributes the chief *rôle* to the marsupials, inasmuch as the dingo is rapidly becoming extinct. It is highly probable that kangaroos are much infested with hydatids in this district as a whole, so that I attach no importance to my inability to find cysts in the few specimens examined by me. It would be very interesting to receive information upon this point from sportsmen of a scientific turn of mind. As regards the sheep, there is no doubt that hydatid infection is very common in them, and that the parasite often co-exists with, and is often mistaken for, fluke. This is not surprising, when we learn that the water supply is the medium of infection in each case. And now as regards the records of the Mount Gambier Hospital. I may remind you that in my statistical paper I gave you, upon the authority of Dr. Jackson, the returns of this hospital for the seven years 1873-1880. They showed that during that period one out of every 53 in-patients treated was a case of hydatids. Of course this represents a very alarming prevalence of the disease; but it was doubted by Professor Tate whether the localization of the disease in the South-East was proven by the cases treated in the Mount Gambier Hospital. Professor Tate was inclined to think that the high reputation of Dr. Jackson—then in charge of the Mount Gambier Hospital—had something to do with the large number of cases of hydatids treated in that institution. This was, of course, a very cogent objection, and during my recent visit to Mount Gambier I brought this question before the notice of Mr. A. K. Varley, the very obliging Secretary of the hospital. This gentleman, who has taken a warm and intelligent interest in this subject, has been kind enough to collect and tabulate for me all the cases of hydatids admitted into the hospital from January, 1869, to December, 1882, *i.e.*, for 14 years. They amount in all to 54 cases, and during the same period there were 3,365 admissions of in-patients duly recorded. So that in round numbers about one out of every 62 cases

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admitted during these 14 years was hydatid. This is a rather lower proportion than that of Dr. Jackson's seven years, but still the difference is not very great. Now, Mr. Varley has recorded the places of residence of these hydatid cases, and this is very important. He states that "all the cases except one are from the South-East, and nearly all from swampy country." This is more than a complete answer to Professor Tate's objection, for Dr. Jackson had a very high reputation as an oculist, and cases of eye diseases came far and wide to reap the fruits of his skill. So that if we eliminated cases of eye diseases that did not come from the South-East, the proportion of hydatids would rise even higher than the figures quoted. Dr. Whittell objected that I had omitted to take corresponding years into account when contrasting the proportional numbers of cases of that disease treated at the Adelaide and Mount Gambier Hospitals. I have now done so, and the results are as follows for the years 1873 to 1880:—Mount Gambier Hospital, one hydatid out of 53 in-patients; Adelaide Hospital, one hydatid out of 144·6 in-patients. So that hydatids were in proportion three times (nearly) as numerous in the Mount Gambier as in the Adelaide Hospital during the seven years in point.

Ten dogs were examined at different places, viz., Millicent, Mount Gambier, and Penola. In each place the parasite was found. In all, four dogs were actually found to be infested, and a larger proportion *may* have been so. As regards both Adelaide and the South-East, 40 per cent. of the stray dogs have Tænia Echinococcus. Of course this is a very serious matter, and it quite explains the frequency of hydatids in man and animals in this country. Even in Iceland Krabbe found only 28 per cent. of the dogs thus dangerous to man and beast. Of ten dogs examined in Melbourne, five contained Tœnia Echinococcus, viz., No. 2 contained hundreds, No. 3 thousands, No. 4 only a few, Nos. 9 and 10 a very few; but in all cases of doubt the specimens were identified by microscopic examination. So that Melbourne dogs appear to be quite as dangerous in this respect as those of Adelaide. The Dog Act is virtually in many parts at least of Victoria a dead letter, for during my recent visit to Melbourne I had the curiosity on two or three occasions to count the dogs provided with, and also those not possessed of, collars. The figures were—Without collars, 59 dogs; with collars, 4 dogs. The dogs counted were wandering about the streets of Melbourne and Richmond. It was much the same at Casterton, Hamilton, and Ballarat. In many of the country towns of Victoria the source of infection of the dogs is evidently the same as in South Australia—*i.e.*, the easy access of stray dogs into slaughterhouses and butchers'

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premises, and the careless habit of throwing offal infected by cysts aside, so that dogs might eat it. In consequence of these observations I am convinced that the elaborate returns so courteously supplied to me by the Victorian Government as to the dogs registered in the various cities, towns, boroughs, and by the Shire Councils do not represent by a vast number the real number of dogs in the province.

As regards the media of conveyance of the tapeworm eggs into the body, there can be no doubt that the water supply is the chief one. There is really every factor at work in the South-East to spread the disease—a large number of sheep, marsupials, &c., to act as "hosts" for the cystic germ; a great many useless dogs which, through want of knowledge of their owners, are allowed to eat the offal of sheep and the viscera of kangaroo caught in the chase; a great area of land, swampy in the winter, and in places perennially so, but at other spots becoming dry or sandy in the summer. Finally, many people are not acquainted with, or too indifferent to, the danger of drinking from water-holes or small swamps; and in excuse it must be remembered that the dangerous draught may be cool, clean-looking, and inviting. Hence we cannot wonder that hydatids are common in man. The perversity of ignorance is often astounding. An influential sheep-farmer in the South-East assured me recently that he had found it almost impossible to prevent station hands in his employment from drinking surface-water, although he had thoughtfully provided an ample supply of wholesome and safe drink for their use.

Discussion.

Mr. Grundy drew Dr. Thomas's attention to the nature of the water supply on the Benara Station. It consisted of two well-watered permanent creeks, and the water collected in underground caves. There was always an abundant supply.

Mr. Todd, C.M.G., remarked that in the country townships the people mainly got their water supply from tanks and wells. He thought that the swamps in the South-East were far too extensive to be capable of becoming infected to any appreciable extent with the ova from the tapeworm of the dog.

Prof. Tate asked Dr. Thomas if he thought the parasite to be endemic.

Dr. Thomas, in replying, made a few remarks respecting prophylactic measures. He thought that the chief of these would be to increase the dog-tax, see that it was rigidly carried out, and take steps to destroy all unregistered dogs. A pure

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water supply was also very important. He thought that Mr. Grundy's statement respecting the abundant water-supply of the Benara Station exceedingly confirmatory of his views respecting one of the chief sources of hydatid infection, viz., a scanty surface supply of water, to which dogs could have access; and that it fully explained why that part of the country should have such a happy exemption from the parasite. With respect to Mr. Todd's objection that the swamps would be too extensive to be capable of being contaminated by dogs, he would say that he had not meant that the whole of the larger swamps had been thus infected, but merely small portions near dwellings and presenting such conditions as he had mentioned, favourable for the reception and retention of the ova, and to which man and the lower animals had easy access. In reply to Prof. Tate's question as to whether he thought the parasite to be endemic in the colony, he said that he thought not, as there was no tradition of the natives having suffered from hydatid disease prior to the coming of the white man. Neither did he think that the dog had brought it here, for as a rule the Tænia Echinococcus did not live for more than twelve weeks in the intestine of the dog, and in the early days of the colony voyages from Europe took a much longer time. In sheep and oxen the hydatid may, on the other hand, remain for years embedded in the tissues; and these were most probably the source of the infection. There appeared to be no increase in the recorded cases of the disease in man at the Adelaide and Mount Gambier Hospitals during the past five years as compared with the previous five.

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On some Improvements in the Construction of Curre's Di-Electric Machine.

By D. B. Adamson.

[Read February 6, 1883.]

My object in coming before the Society on this occasion is principally to detail a few experiments made by me in constructing the machine now before you. Being desirous of rendering it as effective as possible, I took some trouble in experimenting in various ways for that purpose.

The machine is known by the name of "Curre's Di-electric Induction Machine." It consists of two parts, one resembling the common frictional-plate machine with its rubbers and collecting comb; the other of a larger disc overlapping the former, and running as close to it as may be, without touching.

The large disc acts the part of a di-electric between the smaller one and the points of a comb which carries off the electricity toward the prime conductor. The smaller disc, as it passes between the rubbers, becomes charged with positive electricity, and therefore, by induction, attracts negative electricity from the points of the comb, which is deposited on the large disc, and leaves the lower comb and its conductor charged positively. The large disc, which by means of the belt and pulley is made to rotate eight times for every turn of the smaller one, delivers up its charge of negative electricity as it passes the points of the upper comb, and so the prime conductor becomes negatively charged.

By the upright rod which acts on a joint, the ball at the top can be brought nearer to, or removed further from, the prime conductor, so as to show the length of spark the machine can produce.

The wooden apparatus on the top forms no part of Curre's machine, but is an addition of my own, and is a modification of what is known as Winter's ring.

Having finished the machine in the first place without this appendage, although I found it gave out electricity in considerable quantity, I was not satisfied with the length of spark, which was seldom above five inches, and my first experiment was on the slab of ebonite opposite the upper comb. This appendage is by some makers supposed to lengthen the spark by one-third. Others again who have tried it say it has no

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effect whatever, their machines working equally well without it. For my own part, after having experimented with this appendage in various forms, I have laid it aside, replacing it by an ebonite ball. These ebonite balls, I may remark, I have found to be much more effective than brass for the prevention of the escape of electricity.

My next experiment was on the rubbers, the stuffing of which is commonly of horse-hair, but in my machine is composed of sheet-indiarubber about half-inch thick, covered with sheepskin, which forms a good flat surface, and fits closely to the plate.

I thought by raising these rubbers higher there would be less time for the charge to escape from the friction plate before its coming opposite the di-electric, but after having raised them one and a-half inches there was no perceptible difference.

While speaking of the rubbers, I may remark that it is a very common opinion that the electricity generated by the one on the side of the plate farthest from the di-electric is lost or wasted, but that such is not the case is easily proved, as one can be laid off; and we find on applying them alternately that the most distant one is quite as effective as the other.

My next experiment was on the spindle of the upper disc, which being of iron allowed some of the electricity to escape. This spindle I replaced by one made of ebonite, but the slight advantage gained was so small that it was more than counterbalanced by the loss in stiffness; so I laid this aside, and again used the iron one. This spindle I have insulated from the disc.

I next tried the effect of lengthening the upper comb by means of an additional point projecting from the lower ball of the same. This proved to be a decided disadvantage, as it considerably diminished the length of spark, the reason being, as I afterwards found, that the di-electric—while it is from the circumference to a certain distance inwards negatively charged—has at the same time its central parts and spindle equally charged with positive electricity; and so the extra point approaching too near this central portion, instead of receiving an addition, gave up a part of what the comb had already gathered.

As there exists a diversity of opinion as to the best form of collectors, many being highly in favour of those used in "Winter's" machine—which are made in the form of a ring, and having the points set in a groove—I constructed a pair on this plan. These I found not quite so effective as the forks, but this, I think, is to be attributed to their diameter being somewhat less than the length of the forks; otherwise I think their performance would have been very nearly equal.

My next experiment consisted in the introduction of the

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link-shaped appendage on the top of the machine. This contains a continuous core of iron wire, which communicates with the cylinder through the supports at the ends, and works on the same principle as a "Winter's" ring, of which it is a modification, being made in the link-shape for the purpose of keeping it as low as possible. This appendage adds considerably to the length of spark; still I believe the same end might have been attained by making the prime-conductor of larger dimensions.

The last experiment I have to mention is the substitution in the place of the slab of ebonite before-mentioned of one of the ring collectors. This addition I find still farther increases the length of the spark, so that the machine which originally would only spark about six inches, will in its present form, under similar conditions, yield ten-inch sparks.

Notes on the Night Parrot

(Geopsittacus occidentalis).

By F. W. Andrews.

[Read February 6, 1883.]

The Night Parrot (*Geopsittacus occidentalis*) is found in the northern and north-western portions of this colony, and specimens have also been procured from Western Australia.

During the day this bird lies concealed in the inside of a tussock or bunch of porcupine grass (*Triodia*), the inside being pulled out and a snug retreat formed for its protection. Here, also, its rough nest is formed, and four white eggs laid. When the dark shades of evening have fairly set in it comes out to feed, but generally flies direct to the nearest water, which is often at a considerable distance from its nest; in some instances I have known them to fly a distance of four or five miles. After drinking and shaking themselves up a little they fly off to feed on the seeds of the porcupine grass, returning to the water two or three times during the night.

The name given to this bird by the aborigines is "Myrrlumbing," from the supposed resemblance of their whistling note to the sound of that word. They have also a very peculiar croaking note of alarm whilst at the water, which much resembles the loud croak of a frog. On one occasion one of

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these parrots was caught in a hut, where it had apparently been attracted by the light of a bush lamp; it was put into a box with a handful of dry grass. On examination next morning the bird could not be seen; it had placed the dry grass in a heap, and had then drawn out the inside straw by straw until it had formed a hole, in which it had concealed itself.

These birds are pretty generally distributed through the north and north-west of this colony; they come and go according to the nature of the season. When the early season is wet the porcupine grass flourishes and bears large quantities of seed, on which many birds feed; but if, on the contrary, the season is a dry one the grass does not seed, and no birds are to be seen.

I shot some specimens at Cooper's Creek in 1875, when out as collecting naturalist for the late Mr. J. W. Lewis in his exploration of the country about Lake Eyre. They were in that district observed to conceal themselves during the day in the thick patches of shrubby samphire, on the salt flats bordering on the creeks and on Lake Eyre. The first specimen of this bird brought under notice was forwarded to the late Mr. Gould, from Perth, in Western Australia, and was named by him in consequence *Geopsittacus occidentalis*. He was not aware until many years afterwards that it was a night bird, and numerous mistakes were made concerning its habits and economy which I have endeavoured to correct by many years of study and observation.

Bibliographical Notes, by Professor R. Tate.

Geopsittacus occidentalis was first diagnostically made known by Mr. Gould in Proceedings Zoological Society, 1861, p. 100, from a skin sent from Perth. It is described by the same author in his "Handbook to Birds of Australia," 1865, vol. 2, p. 88, and is figured in the "Birds of Australia," supplt., part iv., pl. 2, 1867.

Baron Mueller, towards the end of 1867, transmitted to the Zoological Society's Gardens, London, a living specimen of this singular bird; it was described by the donor as inhabiting the Gawler Ranges in South Australia, and in some respects to be a night-bird, like the Nightjars and Owls. During its short life in the Gardens, its habits were carefully watched, and the results arrived at were—that it is chiefly a nocturnal bird, shows a preference for green food, and that its voice is a double note harsh and loud. The specimen was anatomically examined by Dr. Murie, Prosector to the Society, and his observations are detailed in a paper printed in the Proceedings Zoological Society, 1868, pp. 158-165.

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Diagnoses of a New Genus and Two Species of Compositæ from South Australia.

By Baron Sir F. von Mueller, M.D., F.R.S., &c., Hon. Member.

[Read March 6, 1883.]

Epaltes Tatei.

Annual, dwarf, diffuse, somewhat downy; leaves small, oblong-lanceolar, quite or almost sessile, not decurrent, toothless or towards the summit minutely denticulated; the lower mostly opposite, the upper somewhat crowded; flower-heads small, axillary, sessile; bracts few, irregular, in two or three rows, scarious, whitish, mostly oval, ciliolated, forming a campanular-ovate involucre; female flowers in several circumferential rows, with exceedingly narrow corolla and exserted style-branches; bisexual flowers few, central, partly sterile; corolla widening gradually upwards, towards the summit dark-purplish; fruits minute, cylindrical-ellipsoid, slightly angular, not furrowed, faintly scabrous; pappus on none of the flowers.

On sandy scrub-lands between Wellington and Mason's Look-Out, at the east side of Lake Alexandrina. *(Prof. R. Tate)*.

In external appearance this plant reminds of some minute *Alternanthera*. Stems numerous from a slender root, not exceeding two inches in height. Indument from short crisp to partly papillary hairs. Leaves flat, occasionally some oval, measuring only 2 to 4 lines in length. Flower-heads not above two lines long; when in fruit upwards contracted. Receptacle flat, smooth. Involucrating bracts light-brownish towards the base, occasionally one or more of the innermost rudimentary, these narrow and stalked. Corolla of bisexual flowers comparatively slender, not callous at the base. Style branches not thickened at the summit. Female corollas slightly widened towards the base. Achenes when fully ripe dark-brownish, hardly one-third line long.

The identical species was known to me since very many years from the vicinity of Spencer's Gulf; but as the specimens from there were gathered in mid-summer, all their florets had dropped. It is an early spring plant, for Professor Tate found it in full fruit already at the commencement of October.

I have not ventured to exclude this interesting little weed from a generic position in *Epaltes*, although the outward aspect,

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the disposition of the leaves, the paucity and petaloid coloration of the involucre-bracts, as well as the approach to universality in fruit-ripening flowers would warrant to assign to the species sectional rank under the name *Petalopholis*. Systematically the plant should be placed nearest to *E. Harrisii*.

Still more anomalous in the genus is *E. Cunninghami* through its almost complete diclinism, and through its bisexual flowers being provided with pappus-bristles to the number of five, as shown in the lithogram xxviii of the "Plants of Victoria."

As a genus *Epaltes* shows also some affinity to *Elachanthus*, *Isoetopsis*, and *Stuartina*.

[Read April 3, 1883.]

Achnophora.

Flower-head heterogamous. Bracts in few rows, of unequal length, nearly ovate, not much pointed, membranous at the margin, forming an almost hemispheric involucre. Receptacle conically raised at its centre, bearing as many canalicular-lanceolate deciduous bracts as flowers. Outermost flowers ligulate and female, the other flowers bisexual, all fruit-bearing. Corolla of the bisexual flowers tubular, slightly widened upwards, terminated by five or rarely four deltoid very short tooth-like lobes. Anthers narrow-acuminate, without basal appendages. Stigmata short, capillary, neither truncated nor dilated at the end. Achenes semiovate, wedge shaped, somewhat three or four-angular. Segments of the pappus eight to twelve, semilanceolar-subulate, flat, very slightly ciliated.

A stemless glabrous herb, in appearance like the smaller species of *Brachycome*, with bundles of short rather thick rootlets with all the leaves radical filiform-linear and quite entire, on broader clasping and rather long and membranous stalks with elongated single-headed bractless flower-stalks, with pale ligules and silky slightly compressed achenes.

This new genus of Asteroideæ differs from *Nablonium* in the involucral bracts being more unequal, in the development of ray-flowers, in not distinctly bi-tailed anthers, in acute stigmata, as well as in the number and tender texture of the pappus-segments. From *Calotis* it is at once removed by the presence of bracts on the receptacle, as also by the structure of the pappus, in which latter respect it is nearer *Quinetia;* from *Erodiophyllum* and *Ammobium* it is still more widely distant. But it shows among Extra-Australian genera some approach to the South African *Amellus*, though it is readily separable by habit, by more deciduous floral bracts and particularly by the pappus and achenes.

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Achnophora Tatei.

On wet heathy ground about two miles east from Karatta, on the Stun'sail Boom River, Kangaroo Island, forming perennial tufts. *(Professor Ralph Tate).*

Leaves three-fourths to one and a half inches long, a half to one line broad. Leaf-stalks measuring one-half to three-fourths of an inch in length, one to two lines in width, pellucid, three nerved. Peduncles thin, about two inches long. Outer involucral bracts shorter than the inner ones, and hardly pellucid towards the margin; inner bracts two or three lines high. Ultimate separate floral bracts entire and membranous at the margin, somewhat broader upwards, reaching as high as their flowers. Corolla of bisexual flower about two lines long. Anthers enclosed. Ligules narrowly oblong-lanceolar, hardly three lines long. Achenes scarcely one line high. Segments of calyx-limb (pappus) brownish-yellow, equal in size or somewhat unequal, but all of one form, about one line long, persistent.

Diagnosis of a New Genus of Verbenaceæ from Arnhem's Land.

By Baron Sir F. von Mueller, M.D., F.R.S., &c., Hon. Member.

[Read May 1, 1883.]

Tatea.

Calyx with a semiovate soon hemispheric tube and five somewhat unequal semiovate deltoid or finally semiorbicular lobes. Corolla with very short blunt irregular lobes of imbricate prefloresence and with a short tube inside bearded towards the middle. Stamens four, inclosed, didynamous. Filaments short, inserted near the middle of the corolla-tube. Anthers almost cordate, longitudinally dehiscent, without any appendage. Style singularly short, deciduous. Stigma minute. Disk none. Ovary two-celled, with a solitary amphitropal ovule in each cell. Fruit drupaceous, ovate-globular, clasped at the base by the persistent calyx, perfectly two-celled, two-seeded or by evanescence of one of the ovules one-seeded. Placentæ axillary, fixed to the middle of the septum, moderately convex. Pericarp baccate. Endocarp bony, wrinkled or furrowed, not splitting. Seeds oblique-

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ovate, impressed at the placenta, fixed at the middle. Testa membranous, pale. Albumen thin, amygdaline. Embryo white, but little shorter than the albumen. Cotyledons plane-convex, free, downwards straight, upwards somewhat bent or twisted. Radicle very short, almost globular, exserted, inferior.

A somewhat hairy herb, stemless or producing a very short stem, with creeping root-stock, with leaves opposite or quaternarily crowded of comparatively large size, of ovate shape, of wedge-shaped attenuation into their very short stalk or sessile base, and of upwards many denticulation, with cymes on rather short peduncles, with narrow or minute bracts, with small flowers and outside black drupes.

This new genus, notwithstanding its albuminous seeds, is better placed into the tribe of Viticeæ than that of Chloanthaceæ, approaching to some extent *Premna*, but introducing unwontedly the feature of a stemless gesneraceous or scrophularinous plant into the order of Verbenaceæ. It is dedicated to the accomplished and unwearied Professor of Natural Science in the University of Adelaide, who himself was the first discoverer of this remarkable botanic novelty.

Tatea subacaulis.

In Arnhem's Land, North Australia, along the route from Bridge Creek to McKinlay River at the Twelve-Mile, on alluvial soil (*Professor Ralph Tate*); near Yam Creek, (*Inspector Foelsche*).

Rhizome sometimes two feet long. Leaves of tender texture, generally four only in number, measuring two to five inches in length and one and a half to three inches in width; always flat, almost glabrescent, paler beneath. Peduncles one to two inches long, beset with very short spreading hairlets. Cyme compound, hardly ever exceeding one and a half inches in length, conspersed with minute glands irrespective of its copious hairlets. Calyces one to one and a half lines long. Corolla about twice as long as the calyx, glabrous outside. Upper anthers at least sometimes smaller than the others. Style only about two-thirds of a line long. Fruit measuring three to four lines.

This plant is principally in flower from March to April, and ripens its fruit towards the end of the year.

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The Proteaceæ of the Victorian Alps,

With an Introduction on the Topographical and Geological Features of that Region.

By James Stirling, Corresponding Member.

[Read April 3, 1883.]

The Australian Alps, in Victoria, may be described as consisting of a vast extent of mountains traversing the south-eastern portion of Australia; flanked on the south-east by lower lying tracts, which embrace the lacustrine areas of Gippsland, and on the north by the extensive levels of the Murray basin.

The central mountain mass does not, however, present to us an original axis of elevation, but, on the contrary, the area embraced by what is now called the Main Dividing Range was during Miocene times covered by an extensive plateau. Since that period long-continued sub-aerial denudation has eroded drainage channels, and has so altered the surface configuration as to produce orographical features essentially different from those which existed during the Miocene period. It seems probable that the present drainage channels, especially those forming the Murray-source affluents, were considerably influenced by the pre-existing meridional corrugations of the Palæozoic rock masses, as well as by their composition and texture. Whether these regions were subjected to a period of climatic conditions analagous to that which formed the glacial epoch of Europe is a matter of some uncertainty, as no precise data exist, as far as known at present, for aiding in the solution of the problem. However, from the remarks made by Prof. Tate in his admirable "Address to the Royal Society of South Australia," vol. II., p. lxiv., it would appear that there are not wanting evidences of glacial action in South Australia; it would, therefore, be at least probable that the Australian Alps participated in those glacial movements. I have carefully examined the old lake basins near Omeo, referred to by my friend Mr. A. W. Howitt, F.G.S. (Quart. Jour. Geo. Soc., vol. xxxv., p. 35, 187), and although there are not wanting evidences of transportation in the huge blocks now undergoing decomposition which compose the so-called false bottom of these ancient lake basins or tarns, yet there are no traces of ice

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action in the form of grooved or scratched rock surfaces. It is possible, however, that powerful meteorological conditions during the past have removed by denudation evidences of glacial action such as those referred to by Prof. Tate as existing in South Australian territory. The orographical features of the main watershed line which constitutes the central chain of the Australian Alps is most varied, rising into dome-shaped heights as Mount Hotham, 6,015 feet above sea level; opening out at lower levels into flat, although somewhat limited, expanses of table-lands, as Paw-Paw and Precipice Plains, 5,000 feet above sea level, forming thence an anticlinal ridge; again descending into low gaps or saddlebacks; rising again as a well-defined ridge, which gives place to rugged mountain peaks, as Mount Tambo and the Cobberas, the latter over 6,000 feet above sea level; and finally culminating in the towering heights of Mount Koscuisko, 7,308 feet above sea level. Connected with this main watershed line by ridges of varying width and surface contour are lofty plateaux, snowclad during winter for many months, such as Bogong High Plains, at an elevation of 6,000 feet above sea level, north of it; and the Snowy, Dargo, and Gelantipy tablelands, at 4,000 to 5,000 feet, south of it. These plateaux form the gathering ground of some of the principal streams flowing northerly into the Murray River and southerly into the Gippsland lakes and Southern Ocean. During the midsummer these lofty plateaux, with their verdant aspect, rich carpetings of alpine flowers (principally of the order Compositæ), mosses, and lichens, form a striking and most agreeable contrast with the burnt-up, browned appearance of the lower lands and valleys, languishing in excessive dryness, at this time of the year. The surrounding scenery, as observed from the summit of one of the low rolling ridges intersecting the Bogong High Plains, is very grand and impressive—seas of mountains rising wave-like on every side, presenting in the distance almost infinite shades of blue and purple colouring; while the extreme rarity of the air and other conditions all tend to produce a scene of wild mountain grandeur charming beyond description. Unfortunately, the severity of the winter months and the accumulated snow render these high lands practically inhospitable at that time of the year.

Geologically considered, the Australian Alps may be briefly described as consisting of highly-inclined Lower Palæozoic strata, on the denuded edges of which rest isolated tracts of either Upper Palæozoic strata or Tertiary volcanic sheets. The Lower Palæozoic formation, showing in many places as highly metamorphosed schists surrounded by, or surrounding, more or less central granitic masses, the latter being in all probability the lower portions of the Lower Palæozoic strata

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partially or completely altered by the influence of central heat, and which have become exposed by long-continued processes of sub-aeriel denudation. The Metamorphic rocks are themselves invaded by porphyrites. Among the isolated patches of Upper Palæozoic rocks are remnants of a Devonian formation of limestones and conglomerates, as at Bendi and other localities. The Tertiary basalts occupy mostly elevated positions, forming indeed parts of the lofty plateau before referred to. They appeared to be the remnants of extensive lava flows, filling up the valleys excavated during the Miocene period, while the ancient ridges have in many places become the sites of the present river valleys by the extensive denudation and erosion which subsequently took place. Along the course of the principal streams are deposits of Tertiary gravels all more or less auriferous. The Tertiary formations which fringe the mountain mass on either side do not appear to rise on their flanks to a greater height than 800 feet above the present sea level; or, in other words, the maximum level in respect to the mountain mass at which the sea has stood during Cainozoic time, or the total elevation of the land above sea level during that period.

In order that local collections of indigenous plants may be made scientifically valuable for future phytographic researches, it seems to me that more attention to the precise locality should be noted, so that as the areas become geologically mapped, the formations upon which any given species predominates may be traced out, and by this means aid in determining how far varieties of plants are due to geological or meteorological agencies. As far as our alpine representatives of the order under consideration are concerned, it seems probable that they are confined to the granitic and Silurian areas. It is much to be regretted that many of the names given to prominent peaks of our Australian Alps by our distinguished botanist, Baron von Mueller, during his early botanical explorations, and published in that grand standard work, the "Flora Australiensis," have been subsequently arbitrarily altered, thus leading to confusion in tracing out the stations of any particular species.

As far as known at present our alpine Proteaceous plants are endemic in these elevated regions, and I would remark, *en passant*, that it may be interesting to South Australian botanists to determine how far our alpine species may be correlated with any South Australian species under different climatic and geologic conditions. Most of the species herein referred to occur in the catchment basins of the Mitta Mitta and Hume Rivers, both source affluents of the Murray River.

Of the Proteaceæ as a whole, the researches of Baron

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Mueller, Robt. Brown, Dallachy, Bentham, and others have determined the predominence of species in Western Australia and North-Eastern Australia.* Outside of Australian territory, the order would appear to have a wide geographic range, through New Caledonia, Indian Archipelago, and Eastern tropical Asia to Japan, and also in South Africa and South America. Of the relation of this order of plants to the pre-existing flora of Australia, it seems probable that Proteaceous genera were contemporaneous with the deposition of the Lower Pliocene deposits, the fossil fruit *Conchotheca rotunda* bearing a resemblance to several tropical representatives of the genus *Grevillea*.

As might be inferred from the altitudinal conditions, the Australian Alps present hypsometric zones of vegetation, rising from the gigantic Eucalypts of lower levels, through dense masses of arboreous shrubs clothing the moist heads of gullies at higher elevations, through zones of pasture lands and dwarfed heath-like plants to the treeless region at 6,000 feet, covered with alpine herbs, grasses, mosses, and lichens. Such hypsometric zones, however, do not present us with any great ordinal differences; on the contrary, the shrubs and plants found growing at sub-alpine and alpine heights are, for the most part, dwarfed representatives of lowland genera. There are, of course, a few exceptions to the rule, such as the genus *Orites*, which, as far as known, is limited to the mountainous regions of New South Wales, Victoria, and Tasmania.

List of Species of Proteaceæ.

Persoonia confertiflora	Grevillea ramosissima
" Chamæpeuce	Hakea eriantha
" juniperina	" rugosa
Orites lancifolia	" acicularis
Grevillea alpina	" microcarpa
" Miqueliana	Lomatia ilicifolia
" parviflora	" longifolia
" australis	Banksia marginata

Persoonia confertiflora, Bentham.

This interesting plant forms at elevations between 1,000 and 3,000 feet an erect shrub, but at higher elevations up to 4,500 feet it becomes dwarfed and divaricate. It is most abundant

* From Baron Mueller's "Systematic Census" the following statistics have been compiled:—Total Australian species, 587; number in West Australia, 396; South Australia, 33; Victoria, 51; Tasmania, 23; New South Wales, 127; Queensland, 63; North Australia, 35.—*R. Tate.*

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on the heathy, rocky ridges of Metamorphic schist near Omeo, and also on the Silurian areas at Limestone Creek (head of Murray River) at elevations of 3,000 feet. Its other station is on the Genoa River (*F. v. M.*).

Persoonia Chamæpeuce, Lhotsky.

This is a rather decumbent shrub; is abundant on the undulating ranges of mica schist at elevations between 2,000 and 4,000 feet. It extends as far westward as the Broken River (*F. v. M.*), and northerly to Bathurst, New South Wales.

Persoonia juniperina, Labillardière.

On the margin of source runnels intersecting the basaltic plateau at the head of Victoria River. This species forms a low divaricate shrub seldom exceeding one foot in height. It has a much wider geographic range than either of its congeners, as it has been found growing at the Genoa River; Tasmania, at elevations of 3,200 feet; Wimmera and Glenelg Rivers; and on the higher parts of the Mount Lofty Range in South Australia.

Orites lancifolia, F. v. M.

This very handsome shrub inhabits the rocky summits of the Great Dividing Range as at Mount Hotham, and the high lateral ranges as Mount Feathertop; Mount Bogong, 6,508 feet, and Mount Wellington, principally on Silurian and granitic soils. I have not seen the species below 3,000 feet altitude; its general limit is between 5,000 and 6,000 feet, and appears to flourish best at that zone.

Grevillea alpina, Lindley.

This interesting species is prolific in the ranges around Omeo on Metamorphic schists. It ascends to 4,000 feet. At 3,000 feet it is an erect shrub attaining a height of six feet. At the higher elevations it becomes dwarfed to a low straggling bush scarcely a foot above ground. It extends westerly to the granitic ridges of the Buffalo Ranges to the Upper Yarra Ranges, and further westward to the Grampians.

Grevillea Miqueliana, F. v. M.

On the porphyritic (Lower Devonian probably) ridges near the Omeo Plains, between Mount Sisters and Mount Tambo, at elevations of 4,000 feet, it forms a robust shrub fully ten feet high. It extends westerly in favourable rocky situations along the northern flanks of the Dividing Range to Mount Useful; and has been found by the writer on the Silurian ranges near Grant, south of Dividing Range, at elevations of 4,000 feet.

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Grevillea parviflora, R. Brown.

Along the margin of the streams forming the source affluents of the Mitta Mitta River, on Metamorphic and Silurian areas, it is an erect rather bushy shrub, which attains a height of ten to twelve feet; but at elevations of 4,000 feet it becomes dwarfed. It extends easterly to the Genoa River, to the Illawarra and Blue Mountains in New South Wales; westerly to Portland, and South Australia at Kangaroo Island. It would be interesting to note the difference between the South Australian variety if found growing on the Tertiary formation of Kangaroo Island and our alpine form common to the older Palæozoic and Metamorphic schists.

Grevillea australis, R. Brown.

This much-branched shrub is found growing on the Silurian areas in the Mitchell River source basin south of the Dividing Range, at elevations of 5,000 feet. Near Mount Selwyn it becomes dwarfed and decumbent, clinging to the rocks. It has been found at Mount Wellington and the sources of the Yarra River, and southerly in Tasmania, at elevations of 4,000 feet.

Grevillea ramosissima, Meissner.

This interesting species is apparently confined in Victoria to two stations—the Upper Hume River on Silurian formation (*Baron Mueller*), and at the junction of Livingstone Creek with the Mitta Mitta River on Metamorphic schists. At the latter station it attains a height of three to six feet, and its altitudinal limit is 3,000 feet. It appears to be rapidly undergoing extinction. It is more plentiful in New South Wales, extending to the Goulburn River, Macquarie River, and other localities.

Hakea eriantha, R. Brown.

An erect arborescent shrub, the fruits of which are locally known as hickory nuts; is most abundant on the Silurian areas of the Tambo and Dargo Rivers, south of the Dividing Range, at elevations of from 2,000 to 4,000 feet; and on the gneissic schists of the Mitta Mitta basin, at elevations of 3,000 feet. It extends easterly to the Genoa River, and to the Hastings River and New England, New South Wales.

Hakea rugosa, R. Brown.

A prostrate species; confined, as far as known, in Victoria to the Upper Palæozoic formation at the head of the Macalister River, south of Dividing Range. It is widely distributed in South Australia.

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Hakea acicularis, R. Brown.

An arboreous shrub or small tree. Attains a height of 15 feet on the basaltic ledges of the Dargo High Plains tableland, at Mayford Spur, at an elevation of 5,000 feet. It extends northerly to Port Jackson and Blue Mountains, N.S.W., and southerly to the head of the Macalister River and Tasmania, at elevations of 2,000 to 4,000 feet.

Hakea microcarpa, R. Brown.

This stout, rigid shrub is common along the banks of the streams forming the head waters of the Mitta Mitta River on Metamorphic rocks up to 5,000 feet elevation. On the Omeo Ranges it attains a height of 8 to 12 feet, but becomes almost prostrate at the higher alpine stations. It extends northerly to the Macquarie and Clarence Rivers in New South Wales, and southerly to Tasmania, at elevations of 3,000 feet.

Lomatia ilicifolia, R. Brown.

This is an erect, somewhat arboreous shrub, attaining amid the sub-alpine slopes of our Australian Alps a height of 20 feet; it is most abundant south of the Dividing Range, in the humid gullies at the sources of the Wentworth and other affluents of the Mitchell River, on Silurian soils, at elevations of 3,000 to 5,000 feet. It extends westerly along the Dividing Range to the Delatite Mountains and the Dandenong Ranges, and also to Port Phillip, and northerly to the Clarence River and Snowy Mountains at the heads of the Macleay and Bellinger Rivers, N.S.W.

Lomatia longifolia, R. Brown.

On the Livingstone Creek and Upper Mitta Mitta sources this erect shrub attains a height of 12 feet, on Metamorphic schist areas; on the Mitchell River basin, on the Lower Silurian areas, it is equally robust. It extends westerly to the Buffalo Ranges and King Rivers, and northerly to the Blue Mountains, N.S.W.

Banksia marginata, Cavanilles.

On the rocky ledges of Metamorphic schist, near Omeo, Livingstone Creek, at 2,000 feet elevation, this species forms a small bushy tree. It extends from the Wonnangulla River, on Palæozoic rocks, to Port Phillip; southerly to Tasmania, at elevations of 3,000 feet; westerly to Port Lincoln, in South Australia; and northerly to Port Jackson and Mudgee, in New South Wales.

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Discussion.

Professor Tate, in the course of his remarks, stated that of the sixteen species of *Proteaceæ* inhabiting the alpine region about Omeo four of them occur in South Australia. They are:—

Banksia marginata and *Hakea rugosa*, which he regarded as lowland plants straggling to high elevations; they flourish in the warm regions wherein the annual rainfall is not below 20 inches. The latter species he considered to be of South Australian origin.

Persoonia juniperina is, in South Australia, restricted to the Mount Lofty and Willunga Ranges, and descends rarely below about 1,500 feet elevation. He was inclined to claim it as a survival of an alpine flora of Pliocene date.

Grevillea parviflora in a varietal form is known from two stations on Kangaroo Island, on rich loam in river valleys, both at elevations not much above sea level. The Kangaroo Island plant is readily separable from the alpine one, and he thought that it had fair claim to subspecific rank as *G. halmaturina*.

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Notes of the Dissection of a Compound Ascidian found in St. Vincent's Gulf.

By H. T. Whittell, M.D.

[Read April 3, 1883.]

Plate I.

I do not know whether the Ascidian I am about to describe has been found or named by earlier observers. It is new to me, and differs in many respects from other Ascidians found at the same locality, and from the description of the compound Ascidians given in the text books of zoology. I have found two specimens on different days during the last two months, both floating in the ripple at low water within a little distance of the Glenelg jetty.

The larger one was flattened, oval, and about three inches long by two broad; its thickness was about the third of an inch. In the water it was not unlike a piece of boiled tripe. It was soft and villose over its whole surface except at one portion of the side, where it was smooth and membranous, and in the centre of this smooth surface there was a small round opening which looked like a mouth. This specimen was decomposing when I found it, and I could make nothing out of its structure except that on cutting through it, I found a number of bodies which I supposed to be ova.

The second specimen was very much smaller, but in a good state of preservation. This also had the side opening at about the same part as in the larger one. I preserved this as nearly as possible in its natural condition, and before dissecting it, Professor Tate kindly gave me his opinion that I should find it to be a compound Ascidian. After hardening the specimen in spirit, I commenced the dissection by passing a fine probe through the opening at the side. The probe moved freely in any direction for about a quarter of an inch, but beyond this distance there was resistance. One point of a small scissors was then introduced into the orifice, and the opening was enlarged above and below. An attempt was made from this point to peel off the outer membrane. We know it is easy as a rule in dissecting the solitary Ascidians to separate the outer test from the membranous mantle or second coat. In the specimen now under examination the separation could not be effected except with the assistance of frequent snippings with the

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scissors, and even then the work was anything but clean. In some parts nothing remained but the membrane, together with a portion of the softer tissue on the inner surface, in which, as seen under a simple lens, were numerous small pits, and at the bottom of each of these there was a small opening leading to the exterior (see *a*, fig. 1). On that part of the membrane where the removal had been less successful there remained numerous minute bodies, which at a glance proved the correctness of Professor Tate's diagnosis, each of these being a small Ascidian with its branchial chamber or pharynx, according as we adopt Professor Huxley's or Professor Allman's nomenclature, so beautifully shown that I doubt if any dissection of a larger Ascidian could enable a student to get a more accurate knowledge of this structure. The numerous sago-looking bodies which can be seen by the unaided eye are each the body of an Ascidian, having a complicated organization; but the most striking part of the view is the structure intervening between these bodies and the little openings communicating with the outer world—the so-called branchial chamber or pharynx. Many of these will be seen to be torn from their attachments, but some will be found *in situ*, and afford us a perfect knowledge of their arrangement. If we imagine a Chinese lantern to be divided by horizontal ribs, and the parts between these ribs to consist of many longitudinal bars, separated from each other at intervals, so as to give a bird-cage appearance to the whole, we shall have a rough notion of the appearance of these structures. In some instances the mouth (*b*, fig. 1) is still attached to the border of the opening. Behind this is a conical cap (*c*, fig. 1) denser and less transparent than the other parts, and composed of long flat fusiform cells with central nuclei. This cap, which fits on to the bird-cage structure, is composed of three or four tiers of perpendicular bars divided by the horizontal ribs as already described. Under a high power we can sometimes see here and there the remains of the cilia attached to these bars, by which, as in all the Ascidians, the animal keeps up a constant flow of water through its system. Each of these perpendicular bars appears to be hollow, having on each side a row of oblong cells with central nuclei. In all the specimens examined there was a thickened structure on the outer side of the bird-cage arrangement (*d*, fig. 1), and running up as high as the cap. It is certainly hollow, but terminates in a blind extremity. It has often been asserted that this structure being hollow serves as a means of conveying fluid along the walls of the bird-cage structure, and that the transverse bars are also hollow, and open into this tube. It is probable that the large tube may have some uses of this sort, but I have here a preparation adapted

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Plate I

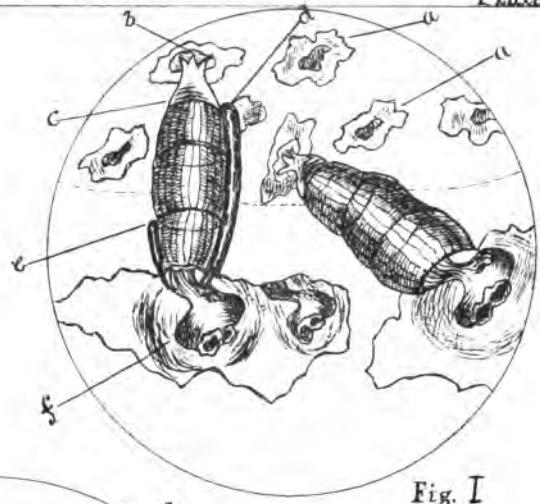

Fig. I

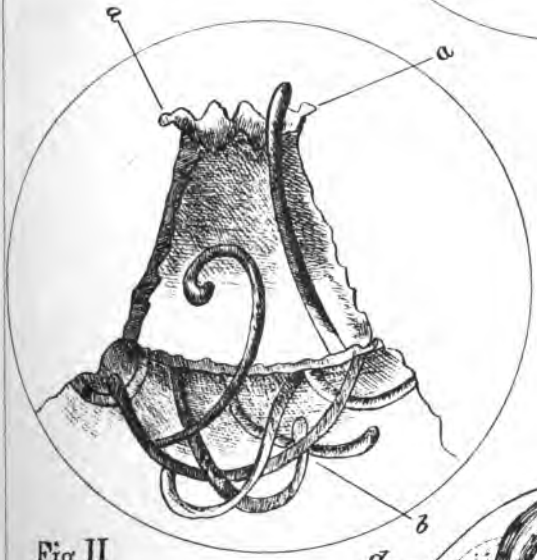

Fig. II

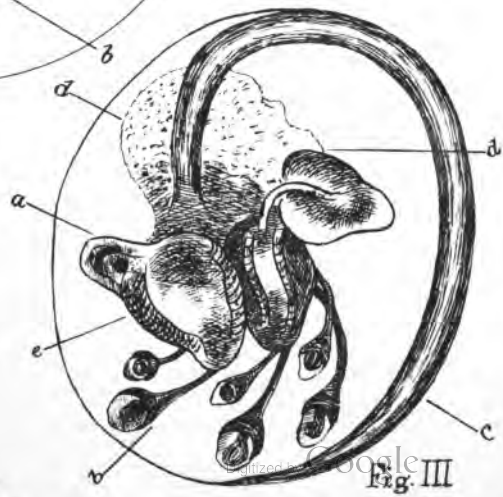

Fig. III

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C. F. Hammond del.

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for the highest powers, and it shows that each of these ribs is in fact a thin band of finely-striated muscular fibres, which can be traced all round the cage, and can be seen to divide into smaller fibres and fibrillæ, which split up and distribute themselves on the walls of the large tube at the side. We can understand the uses of these muscles, which, by contracting, can readily cause the walls of the cage to contract, and eject water rapidly, as Ascidians are known to do, and from which the larger ones get the popular name of sea-squirts. I think it not improbable that the tube at the side also has muscular fibres entering into its structure, but I have not yet been able to demonstrate them.

The end of the cage nearest to the body of the animal is larger than the mouth, and joins by a tube the digestive cavity of the Ascidian.

If we turn again to the mouth of the animal we find seven short leaf-like expansions, which probably admit of motion during life (*a*, fig. 2), but cannot be extended and retracted like the tentacles of the Polyzoa. We know that the absence of vibratile tentacles in Ascidians led to great difference of opinion between no less distinguished observers than Professors Allman and Huxley as to the exact nature of the part I have hitherto mentioned as the bird-cage structure. By Professor Allman the true mouth of the Ascidian is supposed to be at the farther end of the structure, near the digestive cavity; and the ribs and bars of the cage are believed to be the homologues of the tentacles of the Polyzoa. By Huxley the end nearest the outer membrane is believed to be the true mouth; and the cage-like structure is supposed to be a greatly modified and dilated pharynx. My own observations have hitherto inclined me to the views of Professor Allman, but an attentive study of the specimen now under notice leads to the belief that Professor Huxley is more correct. I find attached just within the cap a plentiful supply of conspicuous tentacles, which are sufficiently long to be easily protruded when necessary. In one of my mounts I have seen one or two of these tentacles protruded through the mouth, but in the majority of instances they are retracted, as in the Polyzoa, and lie curled up within the cap. Fig. 2 is an enlarged view of the cap, and at *b* are seen several of these tentacles as observed in a slide I have here for exhibition.

These cage-like bodies separate so easily from the other parts of the Ascidian that hundreds of them were found floating in the water under which the dissection was made.

After the outer membrane had been removed as described, there remained an apparently semi-solid substance in which Ascidians in every stage of development were embedded. A

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longitudinal incision was made through this substance, and it was found after cutting about one-eighth of an inch inward, that the knifeentered a cavity from which fluid was driven out with some force. On examination, it was found that this cavity was lined with a rather tough membrane not unlike the external coat, except that it was much smoother, and no openings could be found in it. I was not prepared for this cavity, and it was too late to take careful measures to ascertain whether it communicated by any canal with any other part of the structure, but a prolonged search with a fine probe did not reveal any such opening, and I am inclined to believe that the only communication between the walls of this cavity and the other portions is by imbibition through the substance of the structure itself.

During the dissection it was abundantly shown that the chief mode of growth, if not the only one, in this compound form was budding. I met with numerous buds growing inward from the lower part of the more mature Ascidians, and also embryo forms in all stages of development. We are all aware that a mass of evidence has been accumulated within the last few years tending to show that the Ascidian is the connecting link in the stage of evolution between the invertebrata and the vertebrata. The young larva of the solitary Ascidian has a tail, but as in the case of the young embryo of man, the tail disappears in the progress of development. Within this tail there is a prolongation of nervous structures, which also disappear, but during the existence of these structures the young Ascidian has a close resemblance to the forms of animals on the border land of vertebrata, as seen in the Amphioxus, one of the primitive forms of fish. I have here specimens of embryos dissected out from the substance of the Ascidian I am describing; some are stained and others are simply mounted in preservative fluid. All these show that even in the compound Ascidians the embryos, though never likely to require to swim about, but always confined in the substance of the tissue, within which they are developed, have long well-formed tails, and in some of the better marked specimens there is evidence that there is within the tail a canal in which cells of a somewhat ovate shape can be distinguished. These tails show under a one-fifth objective unmistakable transverse markings like those of striated muscle. In one of the thicker specimens there are numerous embryos, showing the stages of tail formation. Fig. 3 gives a view of one of these embryos, and *c* shows the fully formed tail winding around the body.

It will be remembered that in the embryo of the solitary Ascidian, and in its early free swimming stage of existence, there is to be seen near the head three rope-like appendages,

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with bell-shaped ends not unlike the ends of the old-fashioned bell-pulls of former days. It has been ascertained that these are suckers, if I may use the expression, by which the young Ascidian ultimately fastens itself to stones or seaweeds when it settles down to a quiet life and a permanent residence. These appendages are remarkably well shown in some of the embryos under notice (fig. 3, *b*). Three are always very distinct, and in some specimens three or four smaller ones are present. It is difficult to understand why they are there, knowing as we do that these embryos can never enjoy a free swimming existence. As the embryo grows we see these appendages lengthen out, and they may be seen traversing the inter-ascidian tissue in all directions, and can be sometimes traced for considerable distances. I suspect that these cords are hollow, and that they form a network of communication between the members of the colony. I must, however, wait for chance to put in my way a few living specimens before this and many other questions can be worked out.

In all the embryo specimens there is a projecting portion of ill-defined tissue (fig. 3, *a*), which is probably nervous, and in it are embedded behind each other two distinct masses of pigment, which I take to be rudimentary eyes; but I do not notice any ocelli between the tentacles of the adult animal.

The digestive organs, nervous system, and organs of circulation are not so distinct in any of my specimens as to enable me to note more than that they appear to have a general resemblance to those of the larger Ascidians. Some specimens I began to prepare yesterday will probably enable me by means of differential staining to get a step onward to more minute details. At present I believe the intestine terminates in a tube passing a short way upward by the side of the pharynx (fig. 3, *e*), opposite to that where the longer tube already described is seen. I have not been able to trace how it communicates with the exterior.

I believe this Ascidian comes nearest to the family of Botryllidæ, but to all appearances it is free swimming.

Explanations to Plate I.

Fig. 1. *a*, Pits in external test; *b*, mouth; *c*, cap; *d*, tube running up side of pharynx; *e*, supposed end of intestine; *f*, body of Ascidian.

Fig. 2. Enlarged view of cap. *a*, Mouth-tentacles; *b*, vibratile tentacles.

Fig. 3. *a*, Eye and otolith; *b*, suckers; *c*, tail; *d*, digestive organs in formation; *e*, birdcage-like pharynx in formation.

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Descriptions of some New Species of Squilla from South Australia.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read May 1, 1883.]

Plate II.

With the aid of Mr. Mier's* "Revision of the Genera and Species of the Squillidæ," I have undertaken with some confidence an examination of the Australian species preserved in the South Australian Museum. These are, with one exception (*Gonodactylus graphurus*, from Edgecombe Bay, Queensland), from the tropical and extra-tropical waters of our province, and are as follows:—

Species from the Northern Territory.

1.—Squilla raphidea, *Fabricius.*

The only example in the collection, which is from the Northern Territory (probably Port Darwin), I have identified with *S. harpax*, De Haan,† placed by Mr. Miers as synonymic with the Fabrician species here named. *S. raphidea* has hitherto been unrecorded for Australia, though it is known from various parts of the Indo-Pacific region. The Port Darwin specimen measures 7¼ inches in length.

2.—Gonodactylus chiragra, *Fabricius.*

Many examples from the Northern Territory, probably Port Darwin, whence I have seen several specimens in the collection of Mr. W. T. Bednall, by whom they were taken.

3.—Gonodactylus graphurus, *White.*

Two examples from the Northern Territory, probably Port Darwin.

The following are also known from Port Essington:—*Lysiosquilla acanthocarpus*, Miers; *Chloridella microphthalma*, M.-Edw.; and *Squilla scorpio*, Latreille.

Species from South Australia.

Mr. Haswell had evidently not been aware of the occurence of any member of the Squilla family in South Australian waters, as in his "Australian Crustacea" not one of the species

* "On the Squillidæ," in Annals Mag. Nat. History 5, vol. 5; 1880.

† "Fauna Japonica, Crustacea," p. 222, t. li., fig. 1; 1850.

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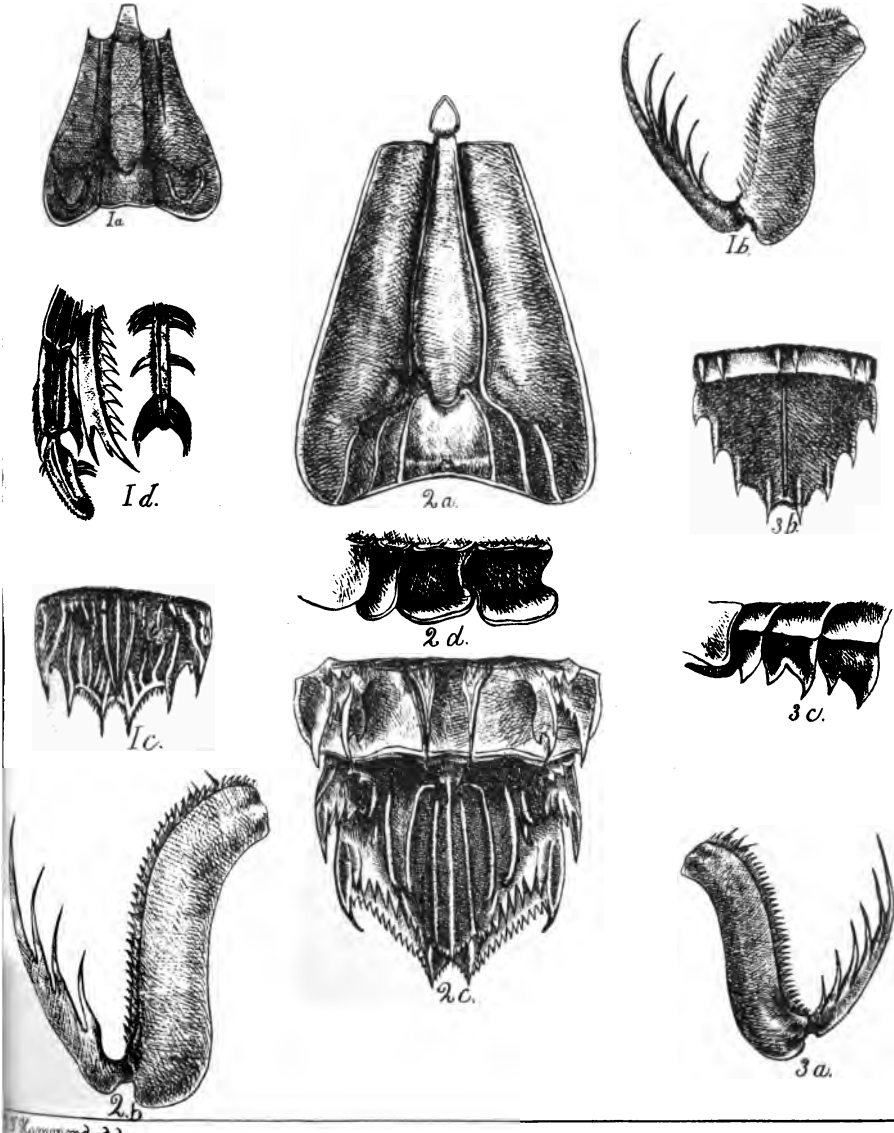
Pl II



J. Hammond. del.

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has assigned to it a South Australian habitat; indeed, our knowledge of the existence of representatives of the family off the whole of the south coast of the continent is limited to *Squilla miles*—a Victorian example of which is in the British Museum. Under these circumstances it is with much satisfaction that I have to report the presence of three species in our much-neglected field of carcinographical research.

These species are, moreover, diagnostically unknown, and I propose to describe them under the names of *Squilla pectinata*, *S. inornata*, and *S. subfasciata*. They agree in one character, namely, that the anterior margin of the penultimate joint of the raptorial limb is furnished throughout its whole length with close-set comb-like teeth. This character is entirely foreign to the genus, though present in *Chloridella* and some species of *Lysiosquilla*. My *S. subfasciata* makes some approach to *Chloridella*, but the generic characters are those proper to *Squilla*.

Following the analytical scheme of Mr. Miers, I have in the subjoined schedule brought the three South Australian species into correlation with others of the genus.

A. Exposed thoracic and first five abdominal segments, with submedian carinæ on the dorsal surface.

I. Penultimate joint of the raptorial limbs without a series of immobile spines.

II. Penultimate joint of the raptorial limbs with immobile spines (or denticulations) along its whole length.

* Armature of penultimate joint spinous, as in *S. raphidea*.

** Armature of penultimate joint consisting of denticles, in addition to the mobile spines.

1. Dactyli of raptorial limbs armed with four spines; antero-lateral angles of carapace rounded ... ... *S. pectinata*
2. Dactyli of raptorial limbs with six spines; antero-lateral angles of carapace spinous ... ... *S. inornata*

B. Exposed thoracic and first five abdominal segments with the dorsal surface smooth.

I. Dactyli of raptorial limbs with six spines; antero-lateral angles of carapace spinous.

1. Penultimate joint of the raptorial limbs without immobile spines ... ... *S. fasciata*
2. Penultimate joint of the raptorial limbs margined with close-set denticles ... *S. subfasciata*

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Squilla pectinata, *spec. nov.*

Species name in allusion to the comb-like front margin of the penultimate joint of the raptorial limbs.

Carapace in the form of a truncated isosceles triangle, with the sides nearly straight, and the angles rounded; length, 1·05, breadth at base, ·85, breadth at front, ·5 of an inch; smooth, very convex in the middle, with the sulci deep and prolonged to the cervical suture. Posterior to the cervical suture are two lateral carinæ on each side. Rostrum semi-oval, as long as broad—0·15 of an inch—partially covering the ophthalmic segment. The exposed thoracic and the first five abdominal segments ornamented with two submedian carinæ, and a lateral carina on each side. The first five abdominal segments have in addition two lateral carinæ inferior to the first on each side; the postero-lateral angles spinulate. The sixth abdominal segment has two submedian and four lateral carinæ, each terminating in a strong spine.

The telson has seven acute longitudinal crests and a few submarginal carunculations, more or less confluent; the median crest terminates in a spine, and the crest on either side of the median one has a few spinulose serrations towards the extremity. The margin is produced into two submedian triangular spines and four lateral spines, the spaces between the submedian and the first lateral spines with about ten strong serratures. The basal prolongation of the uropoda is margined on the inner side with narrow and acute spines gradually increasing in length; the inner of its two elongated terminal spines is slightly longer, and is notched on its outer margin near to the extremity.

The dactyli of the raptorial limbs have four spines, the terminal one more than half the length of the dactylus. Penultimate joint armed on its anterior and superior margin with close set comb-like teeth; there are a few unequal-sized mobile spines in the grooved front of the same joint. The appendages to the thoracic limbs are styliform; the lateral processes of the first exposed thoracic segment is narrow, straight, and acute; those of the following are truncated laterally with rounded angles.

Length of the body, 4½ inches; greatest breadth, 1 inch.

The colour of the specimens preserved in spirit is pale-horn, the costæ and margins of the carapace and thoracic and abdominal segments dark-coloured.

Locality.—Port Adelaide Creek and St. Vincent's Gulf (*S. Aust. Mus.*, three specimens); Fowler's Bay (*Mrs. A. Richards*, one specimen).

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Squilla inornata, *spec. nov.*

Species name in allusion to the unornamented telson.

Carapace with the base much arched, the postero-lateral angles rounded and backward produced, sides slightly excavated, front margin sinuous, the antero-lateral angles are armed with a short spine; median longitudinal diameter, ·51, breadth of base, ·4, breadth of front, ·125 inch. There are three longitudinal carinæ, which are interrupted by the distinctly marked cervical suture, posterior to which, the median carina is bipartite anteriorly and terminates in a spinule.

Rostrum oblong, a little longer than wide, with the lateral margins slightly raised, there is no median ridge; it reaches to the base of the ophthalmic segment.

The exposed thoracic and first six abdominal segments are ornamented with six longitudinal carinæ; all the carinæ of the fifth and sixth, the laterals of the fourth, and the inferior laterals of the third and second abdominal segments terminate in spinules; the postero-lateral angles of the first five abdominal segments spinulose.

The telson is smooth on its upper surface, but is provided with a median crest ending in a spinule; its margin is prolonged into two submedian spines and two laterals on each side. The deep notch between the submedian spines has on each side four blunt denticulations; between the submedian and superior lateral spines there are eight comb-like denticulations.

The distal prolongation of the basal part of the uropoda is armed on the inner edge with minute serratures, and terminates in two unequal spines, the inner one of which is the longer and is armed with a spinule on its outer edge.

The dactyli of the raptorial limbs have six spines, the terminal one half the length of the joint. The penultimate joint much compressed, its anterior edge denticulated through its length; a few mobile spines arise from the marginal groove.

The appendages to the thoracic limbs are styliform. The lateral processes of the exposed segments are bilobate; the anterior lobe of the first of the exposed segments is elongated, curved forward, and acute; in those of the second, third, and fourth exposed segments the posterior lobe is the larger.

Length of body, two and a half inches.

Colour in spirit, greenish-brown.

Locality.—St. Vincent's Gulf (*S. Aust. Mus.*, two examples.)

In general appearance *S. inornata* resembles *S. Dufresnii*, Miers (loc. cit., t. 2, f. 8), but differs in the pectinated margin of the penultimate joint of the raptorial limbs, in the shape of the rostrum, and in the lateral processes of the ex-

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posed thoracic segments. In this last character our species resembles *S. nepa*.

Squilla subfasciata, *spec. nov.*

Species name to indicate its affinity with *S. fasciata*.

Carapace smooth, with a faint lateral carina on each side, widening posteriorly; very convex in the middle, with the sulci deep, and produced to the posterior margin; antero-lateral angles armed with a spine; postero-lateral angles broadly rounded; posterior margin strongly arched. Rostral plate truncatedly trigonous, a little longer than broad, reaching to the base of the ophthalmic segment.

The exposed thoracic and the first five abdominal segments have their medio-dorsal surfaces convex, smooth, but are faintly marked with a lateral carina on each side, whilst the abdominal segments have a stronger carina on each side inferior to the other. The postero-lateral angle and the inferior carinæ of each abdominal segment end in spinules. On the sixth abdominal segment the submedian as well as the lateral carinæ are present and end in spines.

The telson is much broader than long, and is ornamented with a median acute crest, spinous at the end, and about six ridges on each side. The margin is prolonged into six acute teeth, between which are a number of smaller spiniform teeth.

The basal prolongation of the uropoda is armed on its inner edge with narrow and acute spines gradually increasing in length; the inner of its two elongated terminal spines is the longer, and armed with an acute tooth on its outer margin.

The dactyli of the raptorial limbs are six-spined, gradually increasing in size. The anterior margin of the penultimate joint is pectinated throughout its length, and carries on the inferior face a few mobile spines. The appendages of the three post-thoracic limbs are linear-spathulate, flat. The first exposed thoracic segment is not laterally produced, but is armed with a spinule on each side; the following segments are successively broader, scarcely laterally produced, and rounded on the sides.

Length of body, two and one-fourth inches; greatest breadth, one-fourth inch. Colour in spirit, pale straw.

Locality.—St. Vincent's Gulf (*S. Aust. Mus.*, one example).

S. fasciata has much resemblance to *Chloridella microphthalma;* and differs from *S. fasciata* only in its pectinated penultimate joint of the raptorial limbs, in the arched posterior margin of the carapace, and in the truncated apex of the rostral plate.

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Explanations to Plate II.

Fig. 1.—*Squilla subfasciata: a*, carapace; *b*, dactylus and penultimate joint of raptorial limb; *c*, telson; *d*, basal prolongation of uropoda.

Fig. 2.—*Squilla pectinata: a*, carapace; *b*, dactylus and penultimate joint of raptorial limb; *c*, telson and sixth abdominal segment; *d*, lateral view of exposed thoracic segments.

Fig. 3.—*Squilla inornata: a*, dactylus and penultimate joint of raptorial limb; *b*, telson; *c*, lateral view of exposed thoracic segments.

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HOUSE SANITATION.

By JOHN HASLAM.

[Read June 5, 1883.]

[Abridged.]

The subject of sanitation is one that is exercising the thoughts of the professional and scientific world, in the hope of discovering the most effectual means to deal with an enemy that is still defeating their most careful research.

In the air of sewers and house drains the products of decomposition are variable, arising from both solid and liquid excreta, together with house water and other refuse matter poured down the sinks, which pass into the sewers.

Diarrhœa and typhoid fever arise from the air of sewers and fæcal emanations. With regard to the productions of diarrhœa from fæcal emanations, it appears from observations in England that it is intimately connected with temperature, and usually commences when the thermometer is persistently above 60°, and when there is at the time a scarcity of rainfall. I wish to show that it will be in the summer in this climate that any defects in the sanitary arrangements of the city will assert themselves with the greatest persistency, as heat is one of the chief agents in inducing the sewer gas to leave its solitude and poison our homes and surroundings.

The presence of such sewer gas in the air we breathe will be an unfailing source of depression and debility, and will be a certain source of the spread of typhoid fever.

During the last ten years the subject of sanitation has been discussed in England in all its bearings. The results have been varied, but the discussion has established two things.

First.—That when drinking water is contaminated by sewage those who drink the water are in danger of suffering from typhoid fever, diphtheria, scarlet fever, and other febrile ailments classed under the term zymotic.

Second.—That when sewer gas finds its way into a house or its surroundings the inmates are in danger of an outbreak of such zymotic diseases, not to speak of minor illnesses, the connection of which with sewer gas has been clearly established.

We should, therefore, be inspired with the determination to have the best system of house sanitation, together with the

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most efficient ventilation of the sewers, adopted in Adelaide as its system of sewerage is being completed. We have the advantage of knowing what has been done in England by the best engineers; we have the knowledge of the climatic changes of the country, and we ought to have a drainage system based it may be from English practical experience, but adapted to our altered circumstances.

I am indebted to our esteemed President for the comparison of the climatic conditions of Greenwich and Adelaide for the year 1880 (*vide* appendix). I will quote the main points as they bear upon our subject:—

	Greenwich.	Adelaide.
The average mean temperature is	49·5	63·3
" highest reading is	87·5	114·5
" lowest reading is	17·2	35·0
" mean daily range is	15·2	18·9
" humidity is	83·0	57·0
" rainfall is	29·68	22·47

For ten months the mean temperature at Greenwich is under 60°, whilst in Adelaide only during six months does the same temperature prevail. For eight months the highest readings at Greenwich vary from 61·4 to 87·5, whilst in Adelaide the highest readings vary from 63·2 to 114·5.

Barometric changes affect the amount of foul air present in the sewers. The diminution in barometric pressure leads to the escape of gases, which are stored in the interstices of the sewage, and favours decomposition. An increase of barometric pressure enables sewer air to carry a larger amount of the vapour of water, and for the sewage to retain a larger volume of the offensive gases due to decomposition or absorption without parting with them. Temperature and barometric changes are therefore the fruitful agents by which air is liberated from sewage, and it is consequently during atmospheric changes that sewers which appear sweet at other times become offensive and noxious.

Under these conditions, and with the knowledge that in England "preventible disease" caused by drainage is intimately connected with temperature, and, as stated, usually commences when the thermometer is persistently above 60°, inasmuch as then the fæcal emanations reach a certain rapidity of evolution in consequence of the high temperature, it behoves us to examine these figures, which go to prove that in Adelaide the decomposing matter will cause the sewer air to be in a constant state of evolution, and, therefore, requires the most thorough and perfect system of ventilation. I may here say that extreme cold will prevent the germ matter from being diffused,

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and, therefore, restrain decomposition; and this condition may be indefinitely prolonged at or below freezing point, but with an elevation of temperature the liability to undergo change or decomposition immediately returns. Heat above 140° destroys the structure of organic poisons, while it otherwise operates beneficially by producing expansion and consequent dilution of the noxious matter. But under 120° it evolves gaseous matter.

In the ventilators from the sewers to the street level in my opinion columns of sewer gas will be formed through the various causes within the sewers which are always in operations—escapes from which will be determined by the temperature and barometric changes; and thus the air of our streets will be rendered impure by such emanations, and the body less healthy, and, therefore, less capable of resisting disease poisons.

In the treatment of this subject I propose to consider—

1st. House drainage in Adelaide as proposed by the late Mr. Clark.

2nd. House drainage in Adelaide, as enforced by regulations.

3rd. House drainage in Adelaide, as suggested by the author.

I.—Mr. Clark's System.

The report under date January 14, 1878, by the late Mr. Clark distinctly lays down fixed laws, viz., (1) pure air is essential to healthy existence; (2) modern instances are numerous, testifying to the sanitary influence which pure water and efficient drainage have upon the public health; (3) if all the filth which is produced be removed at once and completely before decomposition can take place, and the malarious gases are engendered, the city is in a perfect sanitary condition.

He then states:—"The third use of the sewers is the removal of the water supply after having served its domestic purposes, and with it the excrementitious and other matter which can be conveyed away in running water. To do this perfectly and continuously they must be laid with an inclination which shall insure a certain velocity. There must be no stoppage or stagnation in the stream from the point of inlet to the outlet. If these objects be attained—and they easily can be—it is evident that there will be no time for decomposition to engender noxious gases in the sewer." He then recommends for consideration of the authorities that a plan of the city be made with the points where drainage will be required shown on, such as sinks, closets, water taps, and stack-pipes. The possession of such a plan will enable the engineer to lay out in

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detail all public and private drainage with confidence and accuracy.

In every system of sewers provision for perfect ventilation must be made, as every cubic foot of fluid admitted will displace a similar quantity of air. If no provision be made for escape, the air in the sewer would be under pressure, and tend to force its way through every imperfectly trapped inlet which may be existing; and should such inlet be within the house, the atmosphere thereof would be vitiated.

The means of ventilating the sewers is by small brick chambers placed five or six hundred feet apart, constructed in connection with a manhole at or near the centre of street. The air in escaping passes through a basket of charcoal, and afterwards through an iron grid fixed at the level of street surface, the charcoal rendering the air inodorous. A more active ventilation has in some cases been attempted by connecting the sewers with a furnace or large chimneys. Undoubtedly a more rapid change of the air of the sewers would thus be effected, as the draught would be promoted by the heated chimney. If any stagnation should occur in the sewers of Adelaide it will be due to errors in construction.

When there are several branches to the house drains it is desirable to carry them all to one point into a dip trap. If this be done, no further trapping at the junction of the house drain with the public sewer will be required. A direct communication from this trap to some convenient wall where a ventilating pipe can be fixed is desirable, as it removes all chance of pressure within the pipes, and ensures a perfect ventilation. If the soil pipe be carried for its full size up to the top of the house, and a syphon trap be fixed at its lower end, the ventilation of the pipe will be perfect, and the danger of gas entering the house reduced to a minimum.

Such, gentlemen, is the advice the late Mr. Clark gave the citizens of Adelaide in his report.

II.—The System Enforced by Regulations.

Under the heading of "Descriptive Directions" the regulations say:—"The most important part of a system of deep drainage, such as has been carried out in Adelaide, is the establishment of connections between the sewers and dwelling-houses. Upon the manner in which these connections are made, and the care bestowed upon them, will depend in a great measure the success or failure of the whole undertaking. If the connections are properly made a vast benefit will have been conferred on the community by the construction of the works, and a considerable improvement in the health of the city may be expected; if, however, the connection be improperly made,

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then great injury and inconvenience may result, and the consequences to the public health may be most serious. At the lower end of every house drain what is called a disconnector trap will be fixed; this *will prevent any passage upwards of any gas from the sewer*, whilst at the same time it will admit air to the drain. At the upper end of every drain a ventilating shaft will be placed leading from a second disconnector trap, which receives sinkwater and excreta from closets; and various other descriptions are given on the same principle, and in conclusion adds:—It is *believed* that the best method of constructing house drains has now been clearly indicated, and if the principles pointed out be faithfully adhered to, Adelaide will rejoice in the reputation of being the only city in Australia, and one of the few cities of the world, which possesses a perfect system of house drainage."

In the system adopted by these regulations they are, in my opinion, trapped once too much, causing unnecessary outlay on the part of householders, and I venture to assert will not be effective in their results as a sanitary scheme. Small-bore pipes are all very well in calculation; they will dispose of so much sewage according to their inclinations, but in practice they very soon lose their diameter by furring or corrosion, thereby becoming too small to perform their office, however carefully they may have been laid. The cases of stoppage at the first disconnector from the sewer have been numerous, and there is always liability for such to occur by the very construction of the trap. It is also designed to prevent the passage towards the dwelling of any gas from the sewer, consequently we have this noxious sewer gas thrown back into the main sewer, and delivered at the street level.

III.—The System as Suggested by the Author.

From the various complaints which have been made by the citizens, we are aware that sewer gas is generated on the line of our sewers, which is felt in the summer to be most objectionable, though we are at once met with the statement that this will not occur when the system is complete. Even when the present system is complete, in my opinion smells will always arise at the surface, either in centre of streets or the more objectionable part at our boundaries. The ventilation of the sewers is undoubtedly insufficient. It is now settled beyond doubt that sewer gas will pass water seals in every kind of trap, therefore the sewer gas which cannot get away will in a few hours normally break the seal at the first disconnector trap, and find its way inside the boundary line upwards, particularly when the position of the outlet of these traps stands higher than the crown of the road.

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Though I may be in advance of professional practice, I cannot see why such an obstruction as the boundary trap undoubtedly is should be employed, because the main thing is to have no stoppages; the reason being the conveyance of excreta and sewage should be immediate, every particle committed to the entire ramification of the passages being kept in ceaseless motion until it arrives at the final outlet at the farm. Even considering the natural course of ventilation for the sewers, these traps are objectionable, as they do not allow that freedom of air which is absolutely essential for perfect safety. My objections to traps in this position are the uncertainty of their being changed by the flush used at one deposit, and the danger of their simply becoming small cesspools between the house and the sewers. The awkwardness and expense incurred when a stoppage occurs must not be overlooked, as the traps are fixed at from three to ten feet below the ground level, and also, as I have already mentioned, are liable to derangement and overflow.

It is obviously necessary to discharge the sewer gas as far as possible out of the respired atmosphere, consequently it is wrong in principle to ventilate the sewers into the streets alone; therefore I would do away with the first disconnector trap, and form a disconnecting chamber between the house and the sewers ventilated by a pipe rising above the eaves of buildings, so that the noxious gases may mingle freely with the higher strata of the atmosphere and become oxidised by the stratified zones of heat and consequent currents that traverse and intersect it. The ventilating pipes to house connections would have to be fully considered in laying out the drainage in districts, and not indiscriminately carried six feet above the buildings they chanced to be against. The gratings in the streets would then perform their true functions—that of being the inlet of fresh air, and by a free course being provided to the outlet there would not be any foul gases left in the sewers. Under some conditions of the temperature the action will be reversed, and whichever way the air flows we get nearer to uniformity, and consequently arrive at natural laws. No ventilating pipes from the drain to surface of ground should be allowed within the boundary of property, as the varying distribution of heat in the system of sewers and the relative temperature of the external atmosphere will inevitably cause an escape of sewer gas. For the same reason no ventilating pipe should be allowed to deliver at the surface in confined rights-of-way or narrow streets. In the former case the vertical ventilating pipe from the chamber would be sufficient to prevent their becoming foul, assisted by the ventilating pipe in connection with the pan, and in the latter cases efficient means should be taken at the head of the pipes for ventilation.

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The excreta from soil pipes in connection with water-closets should be delivered by easy bends into the house drains leading to this disconnecting chamber. The top part of these pipes should be carried up to the highest point of roofs for additional ventilation, each watercloset basin having its own trap, which ought in all cases to be provided with an air pipe to prevent syphonage. Then there would be no danger of undue pressure, as the means of its escape is already otherwise provided for in the main ventilator.

The waste-pipes from baths, lavatories, sinks, &c., should be delivered on to a small syphon or other approved trap—the outlets being free to the air above the surface of ground. No sewer gas can then penetrate in their direction. All traps should be of the simplest character, and on no account should one be used which is not self-cleansing with a good flush of water. All house drains should be brought to the disconnecting chamber, and the soil pipes kept distinct from slop-water pipes up to this point.

I would point out that however good the general sewerage may be, unless the drainage proper of the houses and their connections with the sewers are carefully planned, well executed, and maintained in proper order, there is danger of typhoid fever and other diseases. No trade is so important to the public health as that of the plumber. The more thoroughly householders will study and look into the sanitary arrangements of their houses the more obligation will be laid upon architects to see that sanitary work is well provided for in the buildings they design, and display as much care in seeing to the drains as to the more ornate parts of the structure. Badly constructed houses will be a burden to their owners, and as the house is an important factor in the longevity of its inhabitants, it becomes a matter of the utmost consideration to every one what sort of a house they live in. Therefore, no time or expense is wasted that is fairly expended in examining into every minute detail connected with its sanitary condition. People do not realise, even if they have read or have been told, that the laws which bring sewer gas into houses when certain physical conditions are fulfilled are inevitable, unless such precautions are adopted to secure immunity from their presence. The public do not yet realise that the presence of sewer gas in the air they breathe, especially in that of summer nights, when the powers of the body to resist noxious influences are at a low ebb, is certain to produce illness. In other countries this subject is receiving all the attention the most scientific minds can give to it, with a view of arriving at the most perfect system, and I do not see why South Australia may not take its place in the van of progress.

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Appendix.

Comparison of Climate at Greenwich and Adelaide.

Greenwich, 1880.

Months, 1880.	Mean temperature.	Highest reading.	Lowest reading.	Mean daily range.	Humidity. %	Rainfall in inches.
	°	°	°	°		
January	38·3	54·1	17·2	9·6	86	0·261
February	42·1	54·9	23·0	11·4	88	2·357
March	44·2	61·4	27·4	16·2	82	0·595
April	47·2	66·9	34·8	16·0	80	2·205
May	52·6	87·5	31·5	21·8	70	0·497
June	57·5	80·2	37·5	18·6	81	2·257
July	61·6	79·1	47·5	19·1	80	3·812
August	62·8	80·9	46·4	17·1	83	0·978
September	59·7	87·2	43·2	17·5	85	4·002
October	46·4	66·3	29·2	13·1	90	7·653
November	42·8	57·5	25·0	11·9	85	2·060
December	43·3	55·8	26·7	9·8	89	3·005
Year 1880	49·5	87·5	17·2	15·2	83	29·682

Adelaide, 1880.

	°	°	°	°		
January	78·0	114·5	51·0	27·0	37	0·760
February	79·6	106·0	53·0	24·0	44	0·635
March	70·7	95·5	50·5	18·9	55	2·645
April	63·5	82·0	47·0	15·7	63	3·190
May	56·6	72·0	42·0	15·2	71	1·613
June	53·8	65·0	41·6	11·5	78	3·078
July	50·7	63·2	35·0	14·7	76	2·197
August	55·3	71·5	41·0	16·1	66	2·916
September	56·6	76·5	38·9	16·1	68	2·158
October	59·8	82·5	43·0	19·3	60	2·060
November	64·1	91·9	44·2	21·7	55	0·807
December	71·4	108·0	48·0	25·9	43	0·420
Year 1880	63·3	114·5	35·0	18·9	57	22·479

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Discussion.

The President, in asking the Fellows to express their views of the subject on which the paper had just been read, said there could be no more important question than that of drainage. The works at present being carried on in Adelaide were very extensive, and it would be very disappointing if they were not a success. He thought that the smells from the street-gratings were often very disagreeable, and he had noticed that they were worse in summer than in winter. He accounted for this by the greater difference of temperature that existed in the hot weather; this would cause a suction action out of the drain in proportion as the street air became more rarified by the heat. He thought the law of the diffusion of gases would also exert a considerable influence.

Hon. Allan Campbell remarked that by the plan carried out in the formation of the deep drains in Adelaide there could be no storage of sewage anywhere in the system, and consequently no sewer gas could be formed. He thought that there was a good deal of misapprehension on the part of the public as to the nature of sewer gas and of sewer air. The former could only result from decomposing sewage; the latter was simply stagnant or foul air, such as would be noticed in any space that had been shut up for any length of time. In the system of deep drainage they were now considering the only outlet for the sewer air was at the street gratings. The chief factor in causing motion or a current in air was, in his opinion, variations of temperature. He thought that there was a greater stagnation in the air of the drains in summer than in winter owing to the temperature of the outside air being then higher, and therefore lighter, than the sewer air, and hence there would be no tendency for the formation of a current of air into the sewer through the street grating. In winter, on the contrary, the street air being colder, and therefore heavier than the sewer air, there would be a greater tendency for air to enter the drain. The first important point in any system of drainage was to isolate the interior of the houses from any chance of becoming contaminated by the sewer air. He thought that the plan adopted by the South Australian Government was a very effectual method of trapping, and ought to secure the end desired. The second great desideratum was to have a free outlet for the escape of the sewer air at some elevation. This alone would not always ensure a proper ventilation of the drain; and to effect this it might be necessary to place cowls on the ventilating pipes to overcome the stagnation. The tendency to stagnation would not always be equally great, as, for instance, in winter. In reply to an opinion that a high

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temperature of the outside air would be sufficient to cause a current of air from street gratings, he said that it seemed to him quite clear that the summer air being so much lighter could not fail to replace the cooler or heavier sewer air, whilst in winter the case would be reversed, for the sewer air would then be the warmer. There was no doubt that the tendency for gases to mix and become diffused was an important consideration, but he thought that in such a case as ventilating a large system of drains its action would be too slow to be of much practical utility, something much prompter and more effectual being required.

Mr. PARKER, C.E., thought that the deep drainage system in Adelaide was at present illusory, because so few of the closets were connected with it. To make it of any use, connections should be made complete. He condemned the plan suggested by Mr. Haslam of bringing the sewer air nearer to the house. The great danger in all cases was the sewer emanations entering the house. With respect to the proposal to take the sewer air by ventilating pipes to the eaves of the houses, or even five or six feet above them, was, he thought, also very objectionable, for there would be a fear of its falling and entering by the bedroom windows, &c. He thought that the present plan of allowing the air to escape at the street gratings was much safer, as there was a greater chance of its becoming diffused. Before, however, the matter could be fully discussed it would be necessary to collect more data. The size of the sewer pipes was said to be small. Towards evening they would be nearly full of sewage. This would cause a displacement of the air, and serve as a means of ventilating or removing the sewer air daily. It would be necessary to ascertain the relative differences of temperature inside and outside of the sewers, and also as to the direction of the currents of air at the outlets at the street gratings, before the question as to the best method of ventilating the sewers could be profitably discussed.

Mr. RUTT, C.E., pointed out that all the outlets at the street gratings were not at the same level, hence this would cause a current of air to pass sometimes from an upper level to a lower and *vice versa*. It would be necessary to place cowls on the ventilating pipes if they were to produce any effect in causing a ventilation of the drains.

Mr. POLLITZER, C.E., advocated strongly the plan of flushing drains. He thought that the climatic conditions in Adelaide were highly favourable to the successful carrying out of a system of drainage such as he advocated. It would not only carry off all the refuse, but also sweep out all the sewer air. He said that the system of flushing had been found eminently

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satisfactory, whereas as regards the disconnected trap system there is no experience to warrant its utility. He thought the pneumatic suction method was also a very satisfactory one. He would recommend that both be tried.

Mr. BLACK, C.E., agreed with Mr. Rutt as to the effect of the difference between the different street levels. He pointed out that Mr. Haslam's plan necessitated two ventilating pipes. The objection to the disconnected traps was that they collected refuse. He thought smells were often very useful in drawing attention to defects or accumulations of sewage, and that they were not in themselves necessarily injurious.

Mr. MAGAREY, M.B., thought that the hot weather was not the most unhealthy period of the year, notwithstanding that it might interfere with the ventilation of the sewers. It is impossible to say yet what effect the deep drainage will have on the public health, owing to the very imperfect system existing of allowing it to be optional whether a house should be connected or not. To make the drainage system of any use, connection should be compulsory. At present typhoid fever was quite as prevalent in the suburbs as in the city, and it seemed to be worse as one got nearer the hills. In fact, it was all over the country. He thought that there was a great deal of unnecessary alarm in the public mind respecting the deep drainage and the public health.

Hon. ALLAN CAMPBELL differed from Mr. Magarey. He thought that the first cases of typhoid fever were in January. He suggested that Mr. Magarey should give the Society a paper on the origin of typhoid fever. He agreed with Mr. Parker as to the desirability of having more accurate data at command; but he could not see how they would affect the action of a natural law, such as that a heavier stratum of air could not lie above a lighter one, without there being a tendency for a mutual displacement taking place. With respect to the sewer air falling down from the ventilating pipe, he thought the chances were quite as great of its rising to the bed-room windows from the street-gratings. He would insist again upon the absolute necessity for there being a proper system of thorough ventilation in the drains; there should be no smells, and decomposition should be impossible.

Hon. G. W. COTTON asked if there were sufficient data for ascertaining in what direction sewer air would go. This should be ascertained before more money was spent.

Mr. HASLAM, in making a few remarks in reply, said that the great thing was to have a free circulation of air in the drains. He expressed his willingness to confer with the others on the subject at any future time.

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Botanical Notes Relating to South Australia.

By J. G. O. Tepper, F.L.S., Corr. Member.

1. New Localities of Rare Phanerogamous Plants.

[Read February 6, 1883.]

Ixiolæna supina, *F. v. M.* Granite Island, Encounter Bay.
Eriostemon sediflorus, *F. v. M.* Murray Scrub, near Swanport.
Acacia rhigiophylla, *F. v. M.* Murray Scrub. "By me discovered and named in 1848, but since then not again obtained," F. v. M., *in litteris.*
Bertya Mitchelli, *J. Mueller.* Port Victor, Encounter Bay.
Dodonæa hexandra, *F. v. M.* Murray Scrub and Port Victor.
Microtis atrata, *Lindley.* Square Waterhole.
Selaginella Preissiana. Near Clarendon.
Cladium Radula, *R. Br.* Among heathy or scrubby vegetation near the watershed on the ranges between the Meadows and Macclesfield. It is here only twelve to sixteen inches high, growing in numerous small tufts.
Alopecurus geniculatus, *Linn.* Rare in a moist gully between Clarendon and Kangarilla.
Mitrasacme distylis, *F. v. M.* Collected in October, 1882, on the scrubby flat at the foot of Mount Saddlebags, near Kangarilla, in moist spots sheltered by shrubs.

2. List of Algæ and Lichens Collected at New Localities in South Australia.

[Read March 6, 1883.]

The specimens which have served for specific identification were transmitted to Baron Sir F. von Mueller, and by him to the following specialists:—The Algæ, to Professor J. Agardh; and the Lichens, to Prof. J. Mueller, from whom the subjoined names have been received through the same channel:—

Algæ.

Zonaria variegata, *Mart.* Encounter Bay.
Sphacelaria paniculata, *Lgb.* Hallett's Cove, St. Vincent's Gulf.
Cystophora spartioides, *J. Ag.* " "
Halophlegma Preissii, *Sond.* " "
Thamnoclonium codioides, *J. Ag.* " "
Erythroclonium Sonderi, *Harvey.* " "

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Areschougia Laurencia, *Hook.* and *Harv.* Hallett's Cove, St. Vincent's Gulf.
Hymenocladia divaricata, *J. Ag.* Hallett's Cove, St. Vincent's Gulf.
Plocamium nidificum, *Harv.* Hallett's Cove, St. Vincent's Gulf.
Mertensii, *Grev.* " "
angustum, *J. Ag.* " "
Phacelocarpus sessilis, *Harv.* Encounter Bay.
Nitophyllum Curdieanum, *Harv.* "
Galaxaura marginata, *Lamour.* Hallett's Cove.
Gelidium corneum, *Grev.* "
Soliera chordalis, *J. Ag.* "
Rhabdonia dendroides, *Harv.* "
Laurencia Forsteri, *Grev.* "
Asparagopsis Sandfordiana, *Harv.* "
Pollexfenia ciliaris, *J. Ag.*, n. sp. "
Dasya Gunniana, *Harv.* Hallett's Cove.
callithamnion, *Harv.* "
Wrangelioides, *Harv.* "
Caulerpa hypnoides, *R. Brown.* "
Letterstedtia australis "
Fauchea, sp. "

LICHENS.

Heterodea Muelleri, *Nylander;* Lichina confinis, *Agardh;* and Cladonia verticillata, *Floerke.* Clarendon.

3. ADDITIONS TO THE LIST OF AUSTRALIAN AND SOUTH AUSTRALIAN FUNGI.

[Read May 1, 1883.]

The species herein enumerated were collected by me in the neighbourhood of Clarendon mostly during the latter part of last year, and, accompanied by pencil sketches from fresh plants, were sent to Baron Sir Ferd. v. Mueller, who has now forwarded the list of such as have been identified by European specialists, requesting me to report the novelties to this Society. To ascertain them, I compared those in my lists with the census of Australian fungi, published in 1880 by Dr. M. C. Cooke under the title "Fungi Australiani," which, with some addenda issued in 1881, is, I believe, the latest work on the subject. Accordingly, the terms "New for South Australia" mean that the respective fungi are not so recorded in the publications mentioned. There are eighteen species to be mentioned, eight of which are unrecorded for Australia, though occurring elsewhere, and ten have hitherto not been known to occur in this province.

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Hymenomycetes.

1. Agaricus (Psatyrella) squamosus, *Fries*. Species not recorded for Australia. Locality—Clarendon, 24-9-'82, on moist, moss-covered ground; moderately large, being 2⅝ inches high, and the diameter of pileus, 1⅛ inch.
2. Polyporus (Mesopus) oblectans, *Berkeley*. Species not recorded for South Australia. Locality—Scott's Creek, near Clarendon; on moist, black soil; resembling a mushroom somewhat in form. 15-10-'82.
3. Polyporus (Resupinaria) vulgaris, *Fries*. Species new for South Australia. Locality—Jupiter Creek; on charred, wet logs of *Eucalyptus obliqua*. 7-8-'82.
4. Polyporus (?) contiguus, *Fries*. Species not recorded for Australia. Locality—Hills west of Clarendon; in thin sheet-like patches on the *sawn* surface of a dry log of *Eucalyptus leucoxylon*. 12-'82.
5. Stereum elegans, *Fries*. Species recorded from all Australian colonies except South Australia. Locality—Jupiter Creek, 7-8-'82; on much decayed wet bark of *Eucalyptus obliqua*.
6. Stereum spadiceum, *Fries*. Species new for South Australia, but recorded from the same localities as the preceding ones. Locality—Clarendon; on small dead and decayed branches of *Eucalyptus leucoxylon*. 9-9-'82.
7. Stereum sulfuratum, *Fries*. Species not recorded for Australia. Locality—Mount Bold, 13-8-'82; on decaying trunk of *Eucalyptus obliqua*.
8. Tremella albida, *Hudson*. New for South Australia. Locality—Clarendon.
9. Tremella cinnabrina, *Berkeley*. Species not recorded for Australia. Locality—Kangarilla, 29-7-'82; growing from fissures of recently-felled timber of *Eucalyptus rostrata*.
10. Dacromyces stellatus, *Nees*. Species not recorded for Australia.
11. Ileodictyon, sp. The genus with one species, *I. gracile*, is recorded for all Australian colonies except South Australia and Queensland. Locality—Among moss, banks of River Onkaparinga, near Clarendon, 10-9-'82; it is a small, delicate, branching fungus, of fleshy-grey colour, about 1½ inch high.
12. Secotium, sp. The genus new for South Australia, and only recorded with two species from West Australia. Locality, Jupiter Creek, in moist, black soil. A stemless, ovate body, buried almost entirely in the ground; hard, solid, covered with profuse slimy mucilage, and

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orange-yellow colour. Only one specimen was seen. 7-8-'82.

13. FULIGO VARIANS, *Rastof.* Genus and species only recorded for Tasmania. Locality, ridge of hills north of and near Almanda Mine, Scott's Creek, in a hollow cut by the axe in a living tree of *Eucalyptus obliqua*. A white, soft, spongy fungus of indeterminate form, producing a great number of black spores. Only one specimen noticed. 18-2-'82.
14. TORULA PITYOPHILA, *Fries.* The genus with a different species, *T. herbarum*, recorded for Queensland only; thus the genus appears new for South Australia, and the species for Australia. Locality, the seaward incline of the hills west of Clarendon, on the bark of living, dwarfed trees of *Eucalyptus odorata*, 9-9-'82; colour intensely black, in small patches of indefinite shape.
15. RHINOTRICHIUM RAMOSISSIMUM, *Berk.* and *Cooke.* The genus appears new for South Australia, and the species for Australia. Locality, bank of River Onkaparinga, near Mount Bold, 20-9-'82, among shrubs. Form compressed, spherical, regular, 2½ x 1½ inches, colour brownish-grey, with numerous depressed labyrinthine reticulations over the whole surface.
16. PEZIZA BADIOBERBIS, *Berkeley.* Species not recorded for Australia. Locality, hillsides Mount Bold, 20-9-'82, on the ground, forming small, shallow, scarlet-coloured cups.
17. XYLARIA, sp. Genus not recorded for South Australia. Locality, Clarendon, 21-10-'82, on the broken surface of the stump of decaying fencing, sheltered by tall, thick grass. Branching, woody, 1½-inch high; rare.
18. PORONIA PUNCTATA, *Fries.* Locality, hillsides Clarendon, 6-8-'82, on horse droppings. Small, hard, whitish fungus, with a few black pores scattered over the surface.

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Notes on some Rare Birds Collected in the Neighbourhood of Mounts Compass and Jagged.

By F. W. Andrews, Corr. Member.

[Read October 2, 1883.]

An albino variety of the common and well-known Honey-bird (Meliornis Novæ-Hollandiæ).

The belts of Banksias growing in this district are the favourite retreats of the Honey-bird, which is also called the "Whisker-bird," and here they are always to be found. They also live and breed in the gardens and outlying country about Burnside, and are well-known visitors in gardens. Their food consists of honey and occasionally small insects, especially aphides, and may often be seen flying in the air chasing a small moth or butterfly. They make a very compact cup-shaped nest of bark or other suitable material, lining it with the velvety covering of the honeysuckle-cone when this is dry and ripe. They usually lay four eggs of a pinkish-white colour, blotched with pinkish-brown spots, but the colours and markings vary considerably. From authentic information I received, it appeared that three albinos were hatched in one nest. They kept together for a long time, when one of them got chased and killed by some young men who were road making. The second I shot about one mile south from the Square Water Hole on the road to Mount Jagged. The third made off after losing its mate, and was not afterwards seen. One peculiarity of this specimen is that its eyes are white, like the ordinary Honey-bird, and not pink as in most albinos. I found it much wilder than the common ones, and followed this one from bush to bush for a long time; it always concealed itself in the thickest part of the foliage, but kept up a continual chattering, which was a good guide as to its whereabouts. At last it flew some distance away into a thick clump of low mallee bushes situated in the middle of a small plain. On arriving at the spot and going down on one knee, I waited a short time to recover my breath, and then commenced chirruping with my fore finger and lips. I shortly saw it rising from branch to branch, until at last it alighted on the topmost twig. Being all ready, I shot it at once, before it had time to satisfy its curiosity respecting the chirping. When flying about in the scrub it presented a most attractive appearance, and on a care-

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ful examination of the body after skinning it I found it to be a full-grown adult male. It was in this district that I shot an albino emu-wren some years ago.

Lichmera Novæ-Hollandiæ.

I wish to introduce to your notice a bird that at first sight in the bush much resembles the *Meliornis*, but is much scarcer, and frequents higher timber for its food, which consists of honey and insects. This pretty bird is the "Butterfly-bird" of the boys in the district where it is found, and is so-called from the horseshoe-like markings on its breast, giving the front of the bird the appearance of a butterfly.

I have always found it very local in its habitat, its principal haunt being Mount Compass and the deep rocky, thickly-timbered gullies running into the neighbouring ranges. It has a loud bold song, consisting in the male bird of a variety of up and down calls, then a low plaintive song, and then its challenge-like whistle again. The bird may easily be heard a mile off on a fine still day. The female is seldom seen except about the pairing time, and specimens of it are difficult to procure. But when the breeding season approaches, the hen bird secretes herself in some low bush and warbles out such a lovely song, so long and varied in its melodious tones, that the idea of there being no song birds in Australia is at once dispelled. Popular impressions are often far from the truth, and in regard to this matter especially so. I could enumerate several birds having a most pleasing song; I may instance the Redthroat (*Pyrrhalæmus brunneus*), a small bird found at the Gawler Ranges, Cooper's Creek and other outlying places. This little bird has a sweet little song much like a linnet's. Another curious and interesting songster to be heard on a warm evening about swampy country, such as the Square Waterhole, is the Ground Parrot (*Pezoporus formosus*). I say *is* to be heard, but I may almost say was, for the domesticated cats, that have become wild and are now very numerous, have, as it appears, nearly exterminated them in their old retreats. The song of this parrot consists of a perfect octave, given out in very beautiful sweet notes. I was a long time before I could find out what bird it was, and had to shoot one singing in the twilight to be sure of its identity.

Petroica phœnicea.

The flame-breasted Robin is a yearly visitor to the Square Waterhole district. Being a very wet season this year they arrived early, and were first seen on the 25th of April, or about a month before their usual time. The South-East and the swampy parts of South Australia are their principal habitats. In New South Wales they are not so numerous. After their arrival,

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wnich occurs in a flock, they commence to pair and make a cup-shaped nest in a hole in a tree, rock or other similar situation. The nest is made of bark lined with wool, &c. They lay four greenish-white eggs freckled with purple and chesnut-brown, but no two eggs are quite alike. The male bird soon gets very shy and difficult to obtain, hiding himself in the swampy places, where, standing on a clod or stick, he presents a handsome picture—the female the while sitting close about the collector and singing a pretty twittering song. The common Robin may be said to be quite arboreal in its habits, but the bird under notice is quite the reverse, and delights in wet flats with plenty of dead timber on which to perch and show himself off. The peculiar feature in the habits of these birds is that when they have reared their young, say in six or eight weeks after their arrival, they make off again and are seen no more until the following season. Whither do they go?

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A Catalogue of South Australian Minerals.

By T. C. Cloud, Assoc. Roy. Sch. of Mines, F.C.S., F.I.C., Corr. Member.

[Read September 4, 1883.]

In contributing the following catalogue of South Australian minerals I have thought it desirable to offer the ensuing remarks in order that a just estimate may be formed of the trustworthiness of the determinations and of the accuracy of the list of localities given.

When not otherwise mentioned the determinations have been made by myself after a proper physical and chemical examination of the specimens. The correctness of the localities of such minerals as have been determined by myself rests for the most part merely upon the testimony of those who have kindly furnished the specimens, but I have every reason to believe this testimony to be substantially reliable.

The determinations of competent observers have been embodied in this catalogue, and in this connection I would desire to acknowledge my indebtedness to Professor Tate, and to the various papers by Messrs. A. R. C. Selwyn and Geo. H. F. Ulrich, bearing upon the geology and mineralogy of the colony. I am also largely indebted to a little work published in 1846, entitled "Remarks on the Geology and Mineralogy of South Australia," by Thomas Burr, Esq., Deputy Surveyor-General, wherein a considerable number of species and localities are mentioned; and although a few of the species named in the appendix require confirmation, I have deemed it advisable to mention them—if for no other object than that of calling the attention of those interested in the matter to the necessity of seeking in the localities indicated for these species, with the view of having them authoritatively re-determined.

With regard to the order in which the species are placed in this catalogue, I have not thought it desirable to adopt a strictly scientific arrangement, as I consider this list of minerals to form merely a preliminary attempt at cataloguing the species which occur in the colony. At present whole families are unrepresented; further research, however, will doubtless result in the addition of at least some members to these divisions, and a more strictly scientific arrangement will then be practicable.

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In the meantime I have thought it sufficient to arrange them under two general heads, as (A) the so-called non-metallic, and (B) the metallic minerals; the former (A) being sub-divided into carbon, salts of the alkalies, alkaline earths, and alumina, and the anhydrous and hydrous silicates; and the latter (B) into divisions corresponding with their chief metallic constituent. It is hoped that this list of minerals will serve as a starting point, and that contributions in the forms of fresh determinations and new localities may form a not unimportant item in the future transactions of the Society, in which interesting work I trust to be able to personally participate. The nomenclature employed is that adopted by Dana in his "Descriptive Mineralogy."

NON-METALLIC MINERALS.

CARBON.

Diamond.

As far as I am aware the only locality in which this gem has been found is Echunga. The largest example, the property of the South Australian Government, is of a sherry-yellow colour, and weighed before cutting $5\frac{1}{4}$ carats, its present weight being $2\frac{27}{32}$ carats. It is cut in the form of a brilliant. A second specimen (also the property of the Government), somewhat lighter in colour than the foregoing, weighed before cutting $3\frac{1}{2}$ carats, the cutting reducing its weight to $1\frac{15}{32}$ carats. Two very good specimens, illustrating the crystalline form of the diamond, are to be noted—one weighing $1\frac{1}{2}$ carats, and exhibiting the planes of the hexakis-octahedron, and the other weighing $\frac{15}{16}$ carats, and presenting the form of the triakis-octahedron.

Graphite.

This mineral occurs at Warrow, County Flinders, and at one or two localities on the west coast of Spencer Gulf. It has also been found at Mount Charles (G. Francis) and Mount Torrens (C. Thomas). Burr mentions it as occurring in the Belvidere Range, and about 23 miles north-east of Adelaide.

Sulphur.

This mineral occurs in a specimen of pyrite associated with quartz from Echunga (the specimen is in the collection of the South Australian Institute). Burr mentions its occurrence near the Montacute copper mine, enclosed in veins of quartz with pyrite. A deposit formed round the mound-springs at Strangways Springs has frequently been reported to be sulphur. It is, however, chiefly salt coloured yellow by a basic salt of iron.

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SALTS OF THE ALKALIES, ALKALINE EARTHS, AND ALUMINA.

Halite (*Common Salt*).

This mineral occurs in beds near and on the shores of the various salt lakes of the colony, and Tate reports it in the form of an efflorescence on the faces of the cliffs of the River Murray.

Barite (*Barytes—Heavy Spar*)

Occurs at the Wheal Coglin Mine, Rapid Bay; at Apoinga; also at the Burra Burra, Great Gladstone, and Rhondda Mines. Selwyn reports its occurrence at the Emu Flat Copper Mine, and Ulrich at the Blinman Mine.

Celestite (*Celestine*).

I have met with this mineral in the form of radiated crystalline nodules in a bed of clay, Hundred of Wallaroo.

Gypsum.

The crystallised variety of this mineral *(Selenite)* is frequently met with in the form of isolated lenticular-shaped crystals imbedded in the mud of the salt lakes, notably those of Southern Yorke Peninsula. It is also found massive in the salt lakes. Gypsum also occurs in the following localities:—Wallaroo Mine, Hummocks Range, Kanyaka, Kapunda; near Point Riley, Yorke Peninsula; on the Wirryalpa Run, Central Australia; and fine specimens of the fibrous variety (*Satin Spar*) occur in the Stuart Range, Central Australia. Professor Tate reports its occurrence at the Lady Alice Mine and cliffs of the River Murray, and with red ochre near the springs at the Peake, Central Australia; also in a curious rock-form composed of slightly coherent grains on the north-eastern shore of Lake Alexandrina. Ulrich noticed it in the form of veins at the Beltana Mine, and Burr mentions it as occurring at Brighton.

Calcite.

This mineral, in one or other of its numerous rock forms, is of very common occurrence in the colony, although good crystallised specimens are not as frequent as might be expected. Finely crystallised specimens have, however, been obtained from the Wallaroo Mines. The most noticeable of these are in the form of six-sided prismatic crystals, formed by a very acute rhombohedron, terminated by an obtuse rhombohedron of the opposite sign; another form, which is almost unique, being a triangular prism with a rhombohedral termination. A very flat lenticular form is also found. It also occurs coarsely crystalline and milk-white with the copper ore in the above-mentioned and neighbouring mines.

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The Iceland spar variety occurs at Angaston, as do also various coloured marbles. Ordinary marble at Kapunda, and in thin veins in the metamorphic rocks near Franklin Harbour. Calcite also occurs at the Yudanamutana Mine. Ulrich reports white calcite, generally imperfectly crystallised, at the Blinman Mine. Tate reports it between Mounts Parry and Playfair, Central Australia; in the stalactitic form at Cape Jervis; massive and in scalenohedrons at New Mecklenburg, near Lyndoch; and also states that it occurs in the quartz veins in the metamorphic rocks in the neighbourhood of the Peak, and as a cellular calcareous tufa forming the top crust of the Mound Springs of the same neighbourhood. Calcite also occurs at the following localities:—Mount Crawford, Ardrossan, Rapid Bay, Mount Gambier, Point Curtis, Macclesfield, and at Mattawarrangala, in largely crystalline masses.

Tate has described a nearly black, largely crystalline calcite (the colour due to finely divided carbonaceous matter) occupying a vein in a dark-coloured slate at Whyte-Yarcowie.

Burr mentions these additional localities for this species:—Barossa, Flinders, and Mount Lofty Ranges; in the form of calcareous tufa at Flinders and Barossa Ranges, Depôt Creek, near Mount Arden; at Rapid Bay, Crystal Brook, and Rivoli Bay; also on the plains near Mount Hawdon.

Aragonite

Occurs associated with native copper and chalcocite at the Wallaroo Mines; in the form of long prismatic crystals at Armagh, near Clare; and, according to Ulrich, at the Blinman and Oratunga Mines.

Dolomite.

Selwyn mentions this species as occurring at Victoria Creek, Williamstown, (the variety is not stated), and J. E. T. Woods has noticed it in the limestones of Mount Gambier. Burr mentions the following localities:—Belvidere Range, Barossa Range, Rapid Bay, and near Mount Barker. Pearl spar at Rapid Bay and north-east of Adelaide. I have found it as a pseudomorph in a specimen from Central Australia.

Fluorite (*Fluor Spar*).

This mineral was found massive in considerable quantity at the Paramatta Mine, Yorke Peninsula—the colour varying from colourless to sea-green. The purple-coloured mineral occurs in small quantity at the Moonta Mine. Professor Tate mentions it as follows:—In silicious limestone of the Pre-Silurian age, at Field River, between Reynella and the coast, and in Lower Silurian limestone at Parara, near Ardrossan, Yorke Peninsula—the blue variety having been discovered in

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both cases. Burr alludes to its occurrence in the form of cubical crystals at the Kapunda Mine.

Apatite.

This mineral occurs at the Wallaroo Mine, where it was mistaken for fluorite, and I have also met with it amongst the copper ore from the Kurilla Mine. A specimen obtained from the Wallaroo Mine (about one inch in diameter) was of the characteristic sea-green colour, and exhibited the planes of the hexagonal prism; the greater portion of the pyramidal planes were, however, destroyed. Specimens from the Kurilla Mine were in the form of isolated crystals embedded in yellow copper ore; the crystals were of a greenish-grey colour, exhibiting the planes of the hexagonal prism and pyramid, together with the terminal plane of the former. These crystals were about a quarter of an inch long. The chemical, blowpipe and physical characters are those of the mineral apatite.

Magnesite

Occurs in the Flinders Range near Port Pirie, in more or less weathered masses. It is also found scattered about in medium-sized reniform masses on hills of crystalline limestone in the northern part of the Hundred of Cunningham, and it occurs in a large vein on the banks of the Oolabidnie Creek, Hundred of Playford, and in botryoidal masses at Blinman. Burr mentions carbonate of magnesia as occurring in the Mount Lofty and Barossa Ranges.

SILICA.

Quartz.

Rock crystal occurs in various parts of the colony, among which the following may be named:—The mining district of Yorke Peninsula (at the Wallaroo Mine crystals with two perfect terminal pyramids are obtainable), Angaston, Green's Plains, Stanley Mine, Highbury, Barossa Range, Emu Flat near Clare, Lyndoch Valley and Coonatto, while rolled pebbles, frequently mistaken for rolled topaz, are common in several localities in Central Australia—notably near Lake Hope and Charlotte Waters. Tate states this variety occurs at Williamstown, Morialta, Tanunda Creek and Pekina. Burr also reports the following localities for this variety:—Encounter Bay, Montacute Mine, Flaxman Valley, Mount Barker, and the Belvidere Range.

Amethystine quartz occurs at the Wallaroo Mine, and in small veins on the beach north of Point Riley, Yorke Peninsula.

Rose quartz occurs in the Hundred of Cunningham, and Burr mentions its occurrence near the Montacute Mine.

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Smoky quartz.—Fine specimens are obtainable at the Wallaroo Mine, and it occurs at Angaston and Mount Crawford. Burr also notes it at the Belvidere Range.

Milky quartz occurs at the Wallaroo Mine, and Tate reports it at the springs at the Peake, Central Australia.

Bronze-coloured crystals (the colour due to a thin coating of ferric oxide) occur at the Stanley Mine, and also at Emu Flat, near Clare.

Chalcedony occurs at Redruth, Wallaroo Mine, Angaston, and at North Para near Gawler. Tate reports it at the Peake, Central Australia; in the Miocene cliffs at the mouth of the Onkaparinga; and as fossil casts at Ardrossan. Burr names it as occurring at Flaxman Valley, Mount Barker, Barossa Range, and near the Kapunda Mine.

Carnelian is reported by Tate at Stuart Creek, Central Australia.

Heliotrope is reported by Tate at Stuart Creek.

Agate pebbles are to be found at Stuart Creek, near the Charlotte Waters; and at various other places in Central Australia; near the Katherine Telegraph Station. Also, according to Burr, at Flaxman Valley.

Silicious sinter occurs at Angaston, and, according to Burr, at the Barossa Range and Mount Barker.

Flint.—Tate reports this variety in the older Tertiary rocks of Mount Gambier, MacDonnell Bay and Bunda Cliffs. Burr also mentions it as occurring in the form of nodules on the beach at Rivoli Bay.

Hornstone occurs at the Crinnis Mine, and Burr indicates the following localities for this variety:—Barossa Range, Flaxman Valley, and 25 miles north-east of Adelaide.

Jasper occurs at Stuart Range, at Greenock, Ardrossan, and Burra Range. Tate also reports it at Angaston, and near the Peak, Central Australia, and Burr in the Barossa and Belvidere Ranges.

Opal.

Var. Precious Opal.—There is good reason for believing that this variety exists in the colony. It is found in Queensland near the South Australian border, and I have seen specimens which were said to have been discovered just within the border, the locality doubtless being that given by Tate, viz.:—Innamincka, Cooper's Creek.

Girasol.—I have met with a specimen of this variety from near Arkaba, Far North.

Common opal occurs at Angaston and at Mount Crawford in all varieties of colours—notably milk-white, green, yellow, blue, resin-opal and honey-opal. It also occurs at Nuriootpa

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in cellular masses, and at Yudanamutana enclosing ferric oxide (See also under Malachite). Tate reports it at Kelly's Well, 30 miles south of Tennant Creek and in the vicinity of the Peake. Burr mentions the occurrence of common opal of various colours at Flaxman Valley, and of jasp-opal at the Belvidere Range.

Hyalite.—This variety has been noted by Prof. Tate as occurring in the Munno Para hills near Smithfield.

SILICATES (*Anhydrous*).

Pyroxene.

The occurrence of this mineral is reported at Mount Schank by Tate, and by Burr at Mount Gambier, under the name of Augite. The var. Coccolite is also noted by Burr at Mount Gambier.

Amphibole (*Hornblende*),

This species occurs at various localities on Yorke Peninsula, notably at the Wallaroo and Moonta Mines; also at Tanunda Creek, Angaston, in the district about Franklin Harbour and at Tungkillo (Tate).

Var. Asbestus is found at New Mecklenburg, Tungkillo and Angaston; at the Lobethal Mine (Tate) and near Menge Town (Selwyn). Burr mentions the following additional localities:—Mount Barker (with chalcedony and silicious tufa) and the Belvidere Range.

Actinolite occurs at Wallaroo Bay, at Yudanamutana Mine (Ulrich), and, according to Burr, at Lyndoch Valley, Flaxman Valley and near Strathalbyn.

Tremolite at Victoria Creek, Williamstown (Selwyn), and Flaxman Valley and Barossa Range (Burr).

Crocidolite (*Blue Asbestus*).

Ulrich states that this species occurs at the Wirrawilka.

Beryl.

This mineral occurs of various colours—red, blue, green, &c.—at Mount Crawford. The bluish-green variety known as *Aquamarine* occurs there also. The *Emerald* is said to have been discovered by Menge (probably at or near Mount Crawford), but so far as I am aware none of the specimens of this mineral which have been found up to the present time are of sufficient brilliancy and purity of colour to entitle them to rank as valuable gems. Burr mentions Barossa Range for this species.

Chrysolite.

The common variety of this mineral—*Olivine*—occurs, according to J. E. T. Woods, at Mount Schank and extensively in

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the volcanic lavas of Mount Gambier. The variety *Hyalosiderite* is also mentioned by Woods as occurring in the basalt of Mount Schank.

Garnet.

Red crystals of this mineral in white talc are to be found at Kanmantoo. Black garnet occurs at Bundaleer; and garnet-rock—*i.e.*, garnet forming a more or less compact rocky mass—occurs at Monarto. Crystals of iron-garnet occur in the granite rocks at Yadmana in the Hundred of Hawker. Burr mentions the following localities:—Red garnet, Belvidere Range and in the neighbourhood of Mount Barker; black garnet, about 20 miles north-east of Adelaide; and cinnamon stone, Belvidere Range.

Epidote.

The two following localities are named for the occurrence of this mineral:—Barossa Range (Burr) and the Yudanamutana Mine (Ulrich).

Biotite *(Mica.)*

This mineral is of frequent occurrence in the copper mines of Yorke Peninsula, the most characteristic specimen being obtainable at the Yelta Mine, near Moonta.

The following is the result of an analysis of a specimen obtained from the Yelta Mine:—

Silica...	40·28
Magnesia	17·38
Alumina	11·30
Ferric oxide...	5·24
Ferrous oxide	11·65
Manganous oxide	0·30
Lime	0·82
Potash	8·56
Soda	1·64
Water	1·95
Fluorine	trace
	99·12

The specific gravity of this specimen was 2·9. The colour was a dark greenish-black; that of thin laminæ brownish-green.

The occurrence of this species is reported at Williamstown by Selwyn.

Muscovite *(Common Mica)*.

This species forms a common constituent of our granite rocks. The following localities may be more especially noted:—Mount Pleasant, Williamstown, Barossa Ranges and Mount Crawford. Tate reports its occurrence in large trans-

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parent plates at the MacDonnell Ranges; and Burr gives for it (under the name of Mica) these additional localites:—River Gawler, Valley of the Nixon and Yankalilla.

Lapis-lazuli.

I have met with a specimen of this mineral (in the form of veins in white granite), which was said to have been obtained in the Murray Scrub—most probably from near Monarto.

Albite.

This species occurs in veins in the metamorphic rocks exposed in the Oolabidnie Creek near Franklin Harbour. It forms the chief felspathic constituent of the granites of that district.

Orthoclase.

Well crystallized specimens occur at Angaston, and near the Wallaroo Mine; massive and crystalline at Angaston, Ardrossan and Wallaroo. Burr names the following localities: —Barossa Range and east of Mount Barker.

Tourmaline

Occurs at the Moonta and Paramatta Mines, at Mount Crawford, Ardrossan and Angaston; and Tate reports it at Mount Boothby (90 miles north of Alice Springs), where it is said to be abundant; also at Barrow's Creek and in the neighbourhood of the Peake, Central Australia. Burr enumerates these additional localities:—Valley of the Nixon, Barossa Range, Encounter Bay and Rapid Bay; and the variety *Rubellite* also in the valley of the Nixon.

Cyanite.

This mineral is to be found at Nuriootpa in quartz. Burr mentions it as occurring in the colony, but does not give the locality. Selwyn states that it occurs near Menge Town and Mount Crawford.

Topaz.

In this colony the white Topaz appears to be the most commonly occurring variety of this species. It is found near Blanchewater and elsewhere near Lake Eyre, Central Australia.

SILICATES (*Hydrous*).

Allophane

Occurs in the form of a blue deposit in the Miocene rocks of the South-East (J. E. T. Woods).

Talc.

Tate reports the occurrence of this species on the flanks of the Kaiserstuhl, and the var. *Steatite* at New Mecklenburg

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Selwyn names (for crystallised Talc) near Menge Town, Mount Crawford. A bronze-coloured Talc occurs on Yorke Peninsula, and white Talc at the Barossa Range and Kanmantoo. Burr mentions the following additional localities:—Belvidere Range, River Hutt and Lyndoch Valley.

Glauconite.

Professor Tate has noted the occurrence of this mineral in the limestone rocks of the Aldinga cliffs, and the Bunda cliffs of the Great Australian Bight.

Kaolinite.

All varieties of this mineral are to be found in this colony, while ordinary clays consisting of Kaolinite more or less intimately mixed with impurities are abundant. The following are a few of the many localities for the pure white Kaolin:—Wallaroo mining district, Tanunda, Ardrossan, near Charlotte Waters, Hummocks Range and Teatree Gully.

The following are the results of the analysis of two specimens of pure white Kaolin dried at 100° C.—A being obtained from near Point Riley, Hundred of Wallaroo, and B from Teatree Gully, the former comprising an aggregation of pearly scales easily seen under the microscope with a low power:—

	A	B
Alumina	36·18	55·32
Silica	47·53	28·67
Magnesia	·50	·72
Lime	Trace	1·39
Ferric oxide	2·18	1·31
Titanic acid	——	1·62
Alkalies	1·17	1·48
Loss on ignition (chiefly water)	13·31	9·95
	100·87	100·46

In A, the alkalies, being chiefly soda, are calculated as such; in B, they were principally potass and are so calculated.

Tate reports its occurrence at Port Vincent, and of a hard Kaolin clay eight miles west of Charlotte Waters; while Burr mentions white clay on the Gawler Plains at the source of the Angus, Flaxman Valley and River Gawler.

Penninite.

A specimen of the massive variety of this species has reached me from near Beltana, the colour being a fine apple-green. A chemical examination proved the presence of chromium.

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METALLIC MINERALS.

TITANIUM.

Rutile.

This mineral occurs in the form of fair-sized crystals at Lyndoch, Collingrove, Tanunda Creek, Mount Crawford and near Encounter Bay; also (with quartz sand) near Balhannah.

TIN.

Cassiterite.

Although the finding of this mineral has been frequently reported, it is doubtful whether any authentic specimens have been discovered in the southern part of this province. I have a specimen of stream tin in the form of fine grains, which is stated to have been found in the Port Lincoln district; but as the party who is supposed to have found it there failed to obtain a further supply from the same spot, I am compelled to look upon this discovery as very dubious. Rutile in the form of sand and crystals has been frequently mistaken for tin ore. Cassiterite occurs in the Northern Territory at the McKinlay River, Mount Wells &c.

MOLYBDENUM.

Molybdenite

Is of frequent occurrence at the Yelta Mine, and in smaller quantities at the Moonta, Wallaroo, Kurilla and other mines in the same district. Tate also reports it as being found in gneiss near Franklin Harbour.

BISMUTH.

Native Bismuth.

This mineral occurs at the Balhannah Mine and the Murninnie Mine, about 20 miles north of Franklin Harbour.

Bismuthinite

Occurs at the Balhannah Mine.

Bismutite

Occurs at the Balhannah Mine, associated with native gold and chalcopyrite (copper pyrites). Ulrich reports its occurrence at the Stanley Mine.

IRON.

Native Iron.

The only specimen* of Native Iron which has been found, or at any rate scientifically made known, up to the present time is in the form of a mass of meteoric iron obtained in the Gawler Range in November, 1875. As no particulars of this meteorite have hitherto been published, the following informa-

* Now in the South Australian Museum.

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tion may be of interest:—The form is bounded by a series of more or less concave and irregularly-shaped planes. The surface is, for the most part, coated with a somewhat shining and dark-brown oxide of iron. This meteorite consists of metallic iron and contains a small proportion of nickel. It weighs 3,268·7 grm., or 7 lbs. 3¼ ozs. As originally found it was a trifle heavier, a small piece having been broken off by the finder; and the long chisel mark to the right hand on the top shows where an attempt was made to cut off a larger piece. The locality and circumstances attending the discovery of the meteorite are thus described by Mr. James Martlew:—"I found the stone on the flat in a mallee scrub about half a mile from the northern foot of the range, being distant four miles south of Yardea Station. It was about 15 inches under the surface, and was surrounded for about three feet by limestone broken into small pieces. All round this there was from four to eight inches of soil covering the limestone."

Magnetite.

This species occurs near Mount Jagged, and Burr states that the crystallised and massive varieties are of very general occurrence from Cape Jervis to Black Rock Hill. Tate reports it in the vicinity of the Peake, Central Australia, and in the Hundred of Cunningham. The following analysis of a sample of ore from Mount Lofty, by Wallace of Glasgow, may be of interest:—

Ferric oxide...	88·22	Iron, 66·34 per cent.
Ferrous oxide	5·66	
Manganic oxide	·20	
Sulphur	·20	
Iron, combined with sulphur	·18	
Phosphoric acid	·05	
Alumina, &c.	3·24	
Magnesia	1·33	
Silica...	·92	
	100·00	

Hæmatite.

Var. Micaceous Hæmatite occurs at numerous localities in this province, among which may be mentioned the following:—Angaston, Port Lincoln, near Inglewood, at the Yudanamutana Copper Mine and the Paramatta Mine, Yorke Peninsula. It occurs in the quartz veins running through the metamorphic rocks in the neighbourhood of the Peake and at Tennant Creek, Central Australia (Tate). Also in druses in close proximity to the copper deposits at the Blinman Mine (Ulrich)

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and in the Gawler Range, Barossa Range and Mount Lofty Range (Burr).

Compact Columnar (Red Hæmatite) occurs near Port Lincoln, at the Wallaroo Mine, Barossa Range, Angaston and at numerous other places; while Professor Tate notes it at Eudunda, Tennant Creek and in the neighbourhood of the Peake, Central Australia.

Red Ochre occurs at Parachilna, and Tate reports it in the vicinity of the Peake, Central Australia.

MARTITE—(sub-species)

Occurs in the form of octahedral crystals imbedded in micaceous hæmatite, at Carey's Gully, Mount Lofty.

LIMONITE (*Brown Hæmatite*).

This mineral occurs at numerous localities in the province, among which the following are perhaps the most deserving of mention, viz., Angaston, Waukaringa, in and near the Blinman Mine, Munjibbie, Yorke Peninsula, Sixth Creek, near Inglewood, Macclesfield and Hindmarsh Valley.

Limonite pseudomorph after pyrite occurs in the form of isolated and grouped cubical crystals in various parts of Central Australia; and near Lake Eyre, is very plentiful on the surface. Tate also notes it in the vicinity of Eudunda and in most of the auriferous quartz veins in the Mount Pleasant district. It occurs, in the form of pentagonal dodecahedral crystals pseudomorph after pyrite, near Mount Lyndhurst. The following is the result of an analysis of a specimen from Hindmarsh Valley, by Wallace of Glasgow:—

Ferric oxide	76·71=Iron, 53·7 per cent.
Manganic oxide ...	trace
Magnesia	0·30
Lime	0·45
Phosphoric acid ...	1·20
Sulphuric acid ...	0·42
Alumina	3·05
Silica	5·88
Water (combined) ...	10·91
Moisture	1·08
	100·00

Burr mentions the following localities for this species:—Near the Montacute Copper Mine, Rapid Ray and Mount Barker.

MENACCANITE.

Var. Ilmenite occurs at Victoria Creek, Williamstown (Selwyn).

SIDERITE.

Selwyn mentions the occurrence of this species at the

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Crinnis Mine, Ulrich at the Oratunga Mine, Tate at Eudunda and Burr reports it at Rapid Bay, Barossa Range, Mount Lofty Range and various other places. It also occurs at the Karkulto Mine, whence a specimen has been obtained for examination. It was in the form of a largely crystalline mass of a brownish-grey colour. Hardness, 3·5; and specific gravity, 3·9.

The analysis of this specimen yielded the following results (I). No. II, introduced for the sake of comparison, is the composition of a specimen from Mitterberg, Tyrol, quoted from Dana:—

	I.	II.
Ferrous oxide	51·75	51·15
Manganous oxide ...	1·56	1·62
Magnesia	7·31	7·72
Carbonic acid	39·38*	39·51
	100·00	100·00

The composition of the mineral as given above is represented by the formula $4\ FeCO_3 + MgCO_3$. From the composition of this specimen and from that of others, which have from time to time passed through my hands, it would appear that the siderite of this colony is chiefly of the magnesian variety.

Pistomesite.

This mineral occurs in large quantities at the Balhannah Mine, the waste tip being for the most part formed of it. When first obtained this mineral is of a yellowish-grey colour, but on exposure it assumes a bronze-coloured coating.

A preliminary examination showed that the mineral consisted of magnesic, ferrous and manganous carbonates, and at first I was inclined to think that it was Breunnerite, a ferriferous variety of Magnesite. A complete quantitative analysis showed, however, that the mineral had the composition of Pistomesite, with which it also agrees in its physical properties. The specimen for examination was selected from the centre of a large mass, and was free from the incrustation referred to above. The result of the analysis was as follows (I), No. II being the analysis of a specimen from Thurnburg quoted by Dana:—

	I.	II.
Ferrous oxide	33·31	33·92
Magnesia	20·66	21·72
Manganous oxide ...	3·49	—
Carbonic acid	43·52	43·62
	99·98	99·26

*Obtained by difference.

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The hardness of the Balhannah specimen is 3·5. Its specific gravity is 3·5, while that of the Thurnburg specimen is given at 3·4. This species is also reported by Tate as occurring at Nuccaleena.

Pyrite (*Iron pyrites*).

This species is to be found in most of the lodes of the Yorke Peninsula mining district. Finely crystallised specimens exhibiting the form of the pentagonal dodecahedron have been obtained from both the Wallaroo and Paramatta Mines. This form is reported by Burr as occurring at the Montacute Mine and the district in its neighbourhood, and also at Rapid and Encounter Bays. Other localities for this mineral are Talisker Mine and Bundaleer, and it is very general in the various ranges in limestone, quartz, hornstone, slate, and associated with other metalliferous minerals (Burr). A stalactitic form occurs at the Wallaroo Mine.

Arsenopryite (*Mispickel*)

Occurs at the Glen Bar Mine, near Strathalbyn, at the Talisker Mine, and between Victor Harbour and Encounter Bay.

Vivianite.

The massive form of this species occurs at Angaston, and Burr states that the earthy form occurs near Mount Rufus and near Strathalbyn.

MANGANESE.

Pyrolusite.

This species occurs near the Wallaroo Mines both massive and stalactitic; also at Wonna Pandappa Dam and at Waukaringa (Tate)—the specimen from the latter place being an impure variety.

Manganite.

This species is mined for shipment to Europe in the neighborhood of Gordon, between Quorn and Hawker.

Oxides of Manganese of varying composition occur in the Port Lincoln district, at Wonna Pandappa Dam and at various localities in the Far North. Burr reports manganese ores at Rapid Bay, Myponga, Noarlunga, River Light, Barossa Range and Mount Bryan.

ZINC.

Spahlerite (*Zinc blende*).

This mineral occurs at the Wallaroo Mine, and on the west coast of Yorke Peninsula, between Point Pearce and Corney Point. Tate reports it at North Rhine, and L. Seeger at the Wheal Ellen Mine.

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LEAD.

Cerusite

Occurs massive at the Glen Osmond stone quarries. I have found it crystallised with phosgenite in a specimen from the western side of Spencer Gulf, and Ulrich reports it as lining druses at the Beltana Mine, while L. Seeger states that he has met with finely crystallised specimens at the Strathalbyn Mine.

Anglesite.

This species occurs both massive and in the form of small crystals at the Wilpena Pound.

Galenite.

This species occurs in several localities in the province, the most noticeable of which are perhaps the following:—At the Wallaroo Mine (both crystallised and massive), at Waukaringa (Tate), at the Talisker, Glen Osmond, and Blinman Mines (Ulrich), at the Wheal Ellen Mine (Seeger), at North Rhine, near Normanville, near the Yudanamutana Mine, at the Glen Osmond stone quarries; on the Oalmina station, about 150 miles north-east of the Burra; and the Murray Flats. The following additional localities are given by Burr:—Rapid Bay, Lyndoch Valley, and about twenty miles north-east of Mount Barker.

Phosgenite (*Plumbic chloro-carbonate*).

I have met with this mineral associated with cerusite in a specimen obtained from the west coast of Spencer Gulf, the exact locality being unknown; and Burr mentions it as ocurring at the Glen Osmond lead mines.

Pyromorphite.

I have met with massive specimens of this mineral, varying in colour from green to greyish-brown, obtained from the west coast of Spencer Gulf (I am uncertain as to the exact locality), J. E. T. Woods, in a private communication, mentions that he has found phosphate of lead at the Strathalbyn Mine.

NICKEL.

Ullmannite.

This mineral (a double sulphide of antimony and nickel) occurs near Moockra Tower, from whence very characteristic specimens have been obtained.

COBALT.

Erythrite *(Cobalt Bloom)*.

This species has been found at the Glen Bar Mine.

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Cobaltite *(Cobalt Glanz)*.

L. Seeger reports having found this species at the Glen Bar Mine associated with mispickel.

COPPER.

Native Copper.

This mineral species is represented in a great variety of forms in the upper parts of the lodes of the Wallaroo and Moonta mining districts of Yorke Peninsula. Some specimens exhibit well-defined, though distorted crystals; while some very fine examples of the arborescent form have also been produced. In more or less rounded masses it may be said to be common to the lodes of the district. At the Sliding Rock Mine it occurs disseminated in various sized grains. It is also found at Angaston, and to greater or less extent in several of the other copper-bearing lodes of the colony.

Cuprite.

This mineral is of very general occurrence in the upper portions of the copper lodes of this colony, most frequently in the massive form, but finely crystallised specimens are also to be noted. Of these latter, the Moonta Mine has produced some very good examples in which the planes of the octahedron are most fully developed; while the Spring Creek Mine was at one time celebrated for crystals exhibiting the planes of the cube in a very marked degree. The crystals from the Moonta Mine are characterised by an unusually strong metallic lustre. Cuprite is also found in isolated octahedral crystals at the Moonta and Burra Burra Mines; while hopper-shaped octahedral crystals have been met with at the Kapunda Mine.

Crystals have been occasionally obtained from the Burra Burra Mine which were more or less converted into malachite, and in a locality near the Rhondda Mine, north of Port Augusta, they have been found converted into atacamite.

Var. Chalcotrichite.—I have met with this variety of cuprite in a specimen from this colony—the precise locality is unknown. It occurs in groups of small acicular crystals with native copper.

Chalcocite (*Redruthite*).

As far as I am aware, this mineral has not been met with crystallized in the colony. The massive variety is of frequent occurrence in the copper mines of Yorke Peninsula—fine specimens being obtainable more especially from the Moonta Mines. Burr mentions it as occurring at the Kapunda, Montacute, and Burra Burra Mines, and also at Mount Barker.

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Covellite (*Indigo Copper Ore.*)

Very fine specimens of this mineral, in the massive form, have been obtained from the mines on Yorke Peninsula, the most characteristic being chiefly taken from the southern end of the district. A more or less impure variety, black in colour, occurs not unfrequently, more especially in the northern part of the district.

The mineral which generally passes under the name of Melaconite in the Yorke Peninsula mining district is actually *Covellite.*

Burr mentions "black sulphuret of copper" as occurring at the Kapunda Mine.

Bornite (*Purple Copper Ore*).

This mineral occurs at several of the copper mines in the colony, generally associated with chalcopyrite (copper pyrites). The most notable locality is the Moonta Mine. The analysis of a specimen of massive Bornite from the Moonta Mine yielded the following result:—

	I.	II.	III.
Copper	59·84	62·00	61.87
Iron...	11·73	12·15	12·13
Sulphur	24·95	25·85	26·00
Insoluble silicious residue	4·03	—	—
	100·55	100·00	100·00

Column II. shows the composition of the specimen after deducting the insoluble residue, and column III. is the percentage composition calculated from the formula $9\,Cu_2S$, $2\,Fe_2S_3$.

Bornite occurs at the Lady Alice Mine, the Barossa Mine, the Burra Burra Mine and the Try Again Mine.

Tate reports its occurrence in the quartz veins in the metamorphic rocks in the neighbourhood of the Peake, Central Australia, and Burr at the Kapunda Mine.

As far as the writer is aware, the mineral has only been found massive.

Chalcopyrite (*Copper pyrites*).

This mineral is of pretty general occurrence in the lower parts of the copper lodes of the province. It has been found crystallised at the Wallaroo Mine. Some of the crystals in my collection obtained from thence measure from half an inch to three quarters of an inch in diameter.

Although this mineral forms the chief copper ore of the Yorke Peninsula mining district, it only occurs pure in any considerable quantity at the Moonta Mine. In the other parts of the district it is more or less intimately mixed with pyrite, covellite, bornite, &c.

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Fine typical specimens of the ordinary variety and that known as "peacock ore" (from the iridescent tarnish exhibited by some of the fractured surfaces) are obtainable at the Moonta Mine. The analyses of both varieties prove the identity of composition, viz., that represented by the formula Cu_2S, FeS_2, FeS.

The results of the analysis of specimens of this ore from the Moonta Mine are given below. (No. I. is the analysis of the untarnished variety, and No. II. that of the peacock ore. No. III. shows the theoretical composition of pyrite deduced from the formula given above.

	I.	II.	III.
Copper	34·21	34·04	34·57
Iron	30·65	31·14	30·53
Sulphur	35·16	34·34	34·90
Insoluble silicious residue	0·50	0·63	—
	100·52	100·15	100.00

Copper pyrites is reported by Tate as occurring in quartz veins in the metamorphic rock in the neighbourhood of the Peake, Central Australia, while it is noted by Burr as occurring (generally variegated) as follows:—At the Montacute Mine and all the lodes in its vicinity, Rapid Bay, Flaxman Valley, Hutt River &c.

Azurite (*Blue Carbonate of Copper*).

This mineral occurs pretty generally in the copper lodes of the colony, with the exception of those on Yorke Peninsula, where it is rarely met with. The Burra Burra Mine and Kapunda Mine were at one time noted for the quantity of this mineral which they produced. It has also been found at the Blinman Mine, Yudanamutana Mine, &c. &c., and near Franklin Harbour and other places on the west coast of Spencer Gulf.

Malachite

Occurs crystallised in ascicular crystals at the Rhondda Mine, and in brown iron ore at the Wallaroo Mine; also in the same form in the so-called "red jasper rock" at the Yudanamutana Mine. This red jasper is opal, enclosing red oxide of iron, and from an examination of thin sections under the microscope I am inclined to think that we have had here a spongy mass of oxide of iron (probably the cap of a lode) into which silica in the form of opal has infiltered and thus enclosed the oxide of iron). Ulrich mentions the occurrence of this mineral in acicular crystals at the Oratunga Mine.

Nodular and lenticular-shaped masses, with a radiated

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crystalline structure, are not uncommon in the copper-bearing country north of Port Augusta. The ordinary massive malachite occurs at several localities—most notably at the Burra; and Burr mentions the following places (without, however, indicating the form—whether massive or crystallized):—Mount Barker, Montacute Mine, Rapid Bay, Wakefield, near the Horseshoe on the Onkaparinga. It formed the chief ore at the Kapunda and Burra Mines.

Tate states that it occurs in the quartz veins in the metaphoric rocks in the neighbourhood of the Peake, Central Australia. It occurs in perfectly round nodules about three-quarters of an inch in diameter on and near the surface of the country round about Beltana.

It is worthy of note that true malachite does not occur in the Yorke Peninsula mining district. It has there been met with only as atacamite altered more or less into green carbonate of copper by contact with the calcareous rocks.

Sub-species Mysorin.—I have found this mineral of a dark-brown colour occurring with crystallized malachite in red opal rock from the Yudanamutana Mine.

Dioptase.

This form of silicate of copper occurs at the Appialina Mine (Selwyn).

Chrysocolla.

Very good specimens of this mineral, enamel-like in texture, have been found at the Burra Burra Mine, associated with Azurite and Malachite. I have met with characteristic specimens from the Wallaroo and Kurilla Mines, Yorke Peninsula; and Ulrich reports it as occurring at the Nuccaleena, Yudanamutana and Mount Lyndhurst Mines.

Burr mentions its occurrence at the Mount Barker Mine.

Atacamite.

This mineral is known to occur in three distinct states of hydration, the varieties so formed containing in round numbers about 12, 17, and 20 per cent. of water. I incline to the opinion that two, if not all of these varieties occur in this colony; but up to the present time I have only had the opportunity of chemically examining one specimen belonging to the first variety. This mineral is found in every copper mine on Yorke Peninsula, and was at one time represented by most magnificent specimens at the New Cornwall Mine. Perfect crystals nine inches long were found there, and groups of crystals varying from an inch to two or three inches could be obtained in considerable quantity.

The specimen employed for analysis was from the Wallaroo

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Mine, the crystals (which were about one quarter-inch long) being carefully separated from the matrix. The analysis of this specimen yielded the following result (I.). For the sake of comparison I subjoin the analysis of a specimen from Chili (II.) quoted by Dana—

	I.	II.
Copper	13·73	14·54
Chlorine	15·38	16·33
Cupric oxide	55·91	55·94
Water	13·51 (by diff.)	12·96
Insoluble silicious residue	1·47	·08 (quartz?)
	100·00	99·85

It occurs also at the Yudanamutana, Daly and Rhondda Mines. From the latter—situated near Moockra Tower—I have obtained pseudomorphs after cuprite.

SILVER.

Although silver occurs in considerable quantity in some of the lead ores of the colony, so far as I am aware no isolated species containing this metal as an essential constituent has yet been discovered.

GOLD.

"The geological distribution of gold in South Australia is restricted to the Pre-Silurian, certain gravels of the Miocene period, and to drifts of later age. In the first it occurs disseminated in veins of quartz; in the second and third cases as alluvial gold." (Tate).

Among the numerous localities in which gold has been found, in one or other of the conditions mentioned above, the following may be named:—In the sand of the Onkaparinga, South Para and Torrens Rivers; in the Bremer and Barossa Ranges; at Nairne, Woodside, Strathalbyn, Mount Barker, Clarendon, Noarlunga, Currency Creek, Mount Pleasant, Jupiter Creek and Echunga in the Adelaide District; Ulooloo and Waukaringa, North of Burra. At Bigg's Flat near Echunga a few nuggets of an ounce in weight have been obtained.

At the Balhannah Mine gold occurs associated with native bismuth and bismuthinite; at the Lady Alice Mine it has been found in some abundance, associated with bornite; and at the Moonta Mine it also occurs in small quantity associated with the latter mineral.

In the Northern Territory gold is widely distributed over that portion of Arnheim Land occupied by metamorphic rocks. The gold-fields extend from the River Stapleton to the Driffield, a distance of about a hundred miles. The chief centres of

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gold-reefing are the Howley, Twelve-Mile, McKinlay, the Union and Pine Creek. (Prof. Tate's Report on the Northern Territory.)

APPENDIX.

Nitre.

Burr states that efflorescent nitrate of potass occurs on the cliffs of the River Murray, but does not specify the exact locality.

Mirabilite (*Glauber Salt*)

Is stated by Burr to occur in the form of efflorescent crystals at Crystal Brook.

Kalinite (*Potass Alum*).

Burr states that this species occurs mammillated and efflorescent in the gorge of the River Torrens and in the ranges near Mount Barker.

Wavellite.

Burr states that this species occurs at the River Gawler.

Fibrolite.

According to Burr this mineral has been noticed in the Barossa Range.

Melaconite (*Black Oxide of Copper*).

I have not hitherto personally met with a specimen of this mineral, although Burr reports it as occurring both mammillated and earthy at the Kapunda and Montacute Mines.

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List of Plants Unrecorded for Southern Eyre Peninsula.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read October 2, 1883.]

This enumeration is chiefly based upon collections made by our Corresponding Member, Mrs. A. Richards (*A.R.*), while journeying from Port Lincoln to Streaky Bay during October, 1882, and by Mr. Samuel Dixon (*S.D.*) during a recent tour in the country around Port Lincoln.

The asterisk prefixed to a name indicates that the geographical range of the species has been extended to the westward; in the case of *Pteris arguta* the western limit has been shifted 400 miles from Penola, where I gathered it in November of last year. With regard to the other additions, they serve to lessen the width of the wide gap in the longitudinal range of the species, extending in many instances from the mid-southern parts of the province to beyond the frontier of West Australia. The occurrence of *Grevillea parviflora*, *Quinetia Urvillei* and *Calocephalus Drummondii* are noteworthy.

*Papaver aculeatum, Colton, Venus Bay, *A.R.* Drosera glanduligera, *S.D.*; *D. peltata, *S.D.*; D. Menzsiesii, *A.R.* and *S.D.* Comesperma scoparium and Poranthera ericoides, *S.D.* Pelargonium australe, at Colton, *A.R.* *Eriostemon pungens, at Colton, *A.R.*; *S.D.* Claytonia corrigioloides, *S.D.* Daviesia brevifolia and *Pultenæa canaliculata, *S.D.* Goodia medicaginea and *Kennedya monophylla, at Colton, *A.R.* *Acacia rupicola, near Port Lincoln, *A.R.* Acacia myrtifolia, Marble Range, *J. E. Brown.* Haloragis teucrioides, *A.R.* *Melaleuca pustulata, at Denial Bay, *R. Tate.* *Eucalyptus cosmophylla, Marble Range, *J. E. Brown.* Spyridium eriocephalum, *S.D.*; S. vexilliferum and *S. leucophractum, *A.R.* and *S.D.* *Grevillea parviflora—halmaturina, *Conospermum patens and Hydrocotyle callicarpa, *S.D.* Didiscus eriocarpus, *A.R.*, and D. cyanopetalus, *S.D.* Galium umbrosum, *S.D.* *Opercularia scabrida, *A.R.* Calocephalus Drummondii, Rutidosis Pumilo, Quinetia Urvillei and Myriocephalus rhizocephalus, *S.D.* *Helichrysum Baxteri, *A.R.* Microseris Forsteri, at Lake Hamilton, *A.R.* Candollea despecta, Leewenhoekia dubia, Sebæa ovata and Mitrasacme paradoxa, *S.D.* *Styphelia strigosa, *A.R.*; also at base of Marble Range, *J. E. Brown.* Microtis porrifolia and Caladenia latifolia, at Colton, *A.R.*

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Caladenia Patersoni, at Colton, *A.R.*; near Marble Range, *J. E. Brown*. C. deformis, near Marble Range, *J. E. Brown*. Thysanotus Patersoni, Neurachne alopecuroides and Stipa scabra, at Lake Hamilton, *A.R.* Centrolepis aristata, C. strigosa and C. polygyna, *S.D.* *Pteris arguta, limestone-wells five miles back from Streaky Bay, *A.R.*

A List of Unrecorded Plants and of New Localities for Rare Plants in the South-East part of this Colony.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read October 2, 1883.]

During the latter half of November, 1882, I made a long and extensive botanical tour over region E. of the inter-provincial divisions into which I had divided extra-tropical South Australia*, with the special object of tracing out its western limit. Briefly, the region, small as it is, must be considerably reduced in area, but in the present communication I will deal with it as at first delineated. In the course of my explorations I found several species hitherto unrecorded for the region, and discovered not a few rare species at new localities. The chief novelties have already been indicated in my "Additions to the Flora of South Australia," published in the Society's Transactions for this year and last.

Hibbertia stricta. Nangwarry; Mount McIntyre; Yallum (*Miss Allen!*).

Cassytha melantha. Lake George; Cave Range.

Cardamine tenuifolia. Considered by F. v. M. a state of *C. laciniata*; marsh lands about Mount Burr Range, and Mount Julian near Penola.

Stenopetalum lineare. Sandhills, Beachport.

Drosera auriculata. Marsh lands, Mount Graham.

Conesperma calymega. Mount Burr Range; Nangwarry; Mount Julian; Cave Range and Narracoorte.

Elatine Americana. Swamps, Mount Graham.

* Trans. Roy. Soc., S. Aust., vol. iii., p. 48, 1880.

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Pelargonium Rodneyanum. Almost restricted to sandy ground. Mount Graham; Cave Range; Narracoorte; Stewart Range; Reedy Creek.
Boronia pinnata. Mount McIntyre; Nangwarry; near Penola.
Didymotheca thesioides. Rivoli Bay.
Saponaria tubulosa. Cave Range and Narracoorte.
Sagina apetala. Marshes and sandhills, Rivoli Bay; Mosquito Creek.
Lepigonum marinum. Lacepede Bay.
Scleranthus pungens. Cave Range and Narracoorte.
Polycnemon pentandrum. Lacepede Bay and Lake George.
Ptilotus spathulatus. Cave Range and Narracoorte.
Rhagodia Billardieri. Coast Range! and Mount Gambier! (*Rev. J. E. T. Woods.*)
Rumex Brownii. Beachport; Mount Gambier; Yallum Cave near Penola.
Rumex bidens. Cape Northumberland; Lake Leake.
Polygonum prostratum. Mount Graham.
Muhlenbeckia Cunninghamii. Subsaline plains, Narracoorte.
Sphærolobium vimineum. Sphagnum bog, Mount McIntyre.
Pultenæa humilis. Riddoch Bay and Cape Northumberland.
Pultenæa involucrata. Near Yallum (*Miss Allen!*).
Eutaxia empetrifolia. Heathy ground near Lake George.
Acacia pycnantha. Towards the Punt, Glenelg River; near MacDonnell Bay and Beachport.
Acæna ovina. Kingston; Mount Gambier; Cape Northumberland; Cave Range; Narracoorte; Reedy Creek.
Tillæa verticillaris. Beachport; Mount Gambier; Mosquito Creek; Narracoorte.
Tillæa purpurata. Mosquito Creek.
Tillæa recurva. Cape Northumberland; Mount Graham; Lake Edward; Mosquito Creek.
Haloragis ceratophylla. On limestone soil, Beachport.
Haloragis micrantha. Mount Graham swamps.
Epilobium pallidiflorum. Mount Graham swamps.
Lhotzkya genetylloides. Nangwarry; Stewart Range.
Thryptomene ciliata. Near Yallum, Penola; Stewart Range.
Leptospermum myrsinoides. Cape Northumberland, Nangwarry and Penola.
Callistemon coccineus. Heath near Yallum Cave, Penola.
Melaleuca uncinata. Stewart Range.
Melaleuca pustulata. Salt swamps, Rivoli Bay; Yallum Heath; Stewart Range.
Stackhousia linarifolia. Lake George; Cape Northumberland; Riddoch Bay; Nangwarry.
Pomaderris racemosa. Sandhills, Rivoli Bay.
Pimelea serpyllifolia. Beachport.

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Pimelea humilis. Millicent flats to Tarpeena; Nangwarry; Narracoorte and Cave Range.
Pimelea octophylla. Mount Graham; Nangwarry; Penola.
Pimelea phylicoides. Mount Julian, near Penola.
Conospermum patens. Mount McIntyre; Nangwarry; Mount Julian; Stewart Range.
Hakea rugosa. Mount Graham; Yallum; Cave Range.
Hydrocotyle callicarpa. Mount Graham.
Opercularia ovata. Lake George.
Galium australe. Beachport.
Aster floribundus. River Glenelg; The Springs near Mount Graham; Yallum (*Miss Allen!*).
Aster aff. glandulosus. With slender wiry stems and short scattered leaves; achenes densely silky. Yallum (*Miss Allen!*).
Lagenophora Huegelii. Fern brakes, Mount Graham.
Brachycome Muellerii. Lake George; Cave Range; Narracoorte; Mosquito Creek; Reedy Creek.
Siegesbeckia orientalis. Mount Gambier cone; Glencoe Cave.
Eclipta platyglossa. Narracoorte Creek.
Cotula filifolia. Coast swamps Kingston to the River Glenelg; Mount Graham; Yallum (*Miss Allen!*); Mosquito Creek; Narracoorte.
Centipeda Cunninghami. Mount Graham; Penola; Narracoorte.
Myriocephalus rhizocephalus. Nangwarry; Penola to Narracoorte.
Angianthus tomentosus. Narracoorte plain.
Ixodia achilleoides. Yallum (*Miss Allen!*).
Rutidosis Pumilo. Mount Graham; Mount Julian.
Podotheca angustifolia. Sandhills, Rivoli Bay; Mount Gambier.
Leptorrhynchos squamatus. Rivoli Bay; Mount McIntyre; Cave Range; Narracoorte.
Leptorrhynchos tenuifolius. Yallum (*Miss Allen!*).
Helipterum dimorpholepis. Narracoorte Creek.
Erechtites picridioides. Mosquito Plains (*Rev. J. E. T. Woods*); Mosquito Creek.
Erechtites quadridentata. Mount Gambier cone.
Erechtites hispidula. Cape Northumberland.
Cymbonotus Lawsonianus. Benara near Mount Gambier.
Candollea (Stylidium) perpusilla. Yallum (*Miss Allen!*).
Goodenia pinnatifida. Narracoorte Plains
Limosella aquatica. Mount Graham Swamps.
Wilsonia rotundifolia. Subsaline plain, Narracoorte.
Wilsonia Backhousii. Lake George.
Polypompholyx tenella. Yallum (*Miss Allen!*).

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Eritrichium australasicum. Mount Graham.
Cynoglossum suaveolens. Mounts Gambier and Graham; Cape Northumberland; Yallum Cave; Narracoorte Caves.
Verbena officinalis. The Springs, Mount Graham.
Styphelia virgata. Mount McIntyre; Nangwarry; Yallum (*Miss Allen!*)
Brachyloma ciliata. Beachport, Rivoli Bay.
Thelymitra antennifera. Mount McIntyre; Yallum (*Miss Allen!*).
Microtis porrifolia. Mount Burr Range and Mount Graham; Riddoch Bay; Cape Northumberland; Tarpeena.
Pterostylis furcata. Included by Baron Sir F. von Mueller under *P. cucullata*. Lake Edward; Mount Graham.
Diuris palustris. Yallum (*Miss Allen!*).
Caladenia latifolia. Yallum (*Miss Allen!*).
Eriochilus autumnalis. Yallum, near Penola (*Miss Allen!*)
Burchardia umbellata. Tintanulla; Benara; Yallum (*Miss Allen!*).
Thysanotus tuberosus. Lake George; Mount Graham; Tarpeena; Mount Julian; Cave Range.
Chamæscilla corymbosa. Mount Graham.
Bartlingia sessiliflora. Nangwarry; Narracoorte; Yallum (*Miss Allen!*).
Lemna trisulca. Mount Gambier, Valley Lake.
Xanthorrhæa semiplana. Beachport; Mount Graham; Nangwarry to Narracoorte and Stewart Range.
Xanthorrhæa quadrangulata. Sandy ground, Mount Burr; Stewart Range.
Luzula campestris. Beachport; Benara and Mount Gambier.
Juncus cæspititius.
Juncus pauciflorus. Glenelg River; Lake Leake; Mount Graham; Mosquito Creek.
Aphelia gracilis. Mount Graham.
Centrolepis aristata. Mounts Graham and Julian; Narracoorte Creek.
Centrolepis fascicularis. Mount Julian.
Centrolepis strigosa. Mount Graham; Cave Range.
Lepidosperma viscidum. Beachport.
Lepidosperma laterale. Margining swamps, Mount Graham; Tarpeena; Mount Julian.
Lepidosperma carphoides. Heathy ground, Yallum; Nangwarry; Cave Range.
Heleocharis sphacelata. Lake Leake.
Heleocharis acuta. Glenelg River; Riddoch Bay; Mount Gambier; Mosquito Creek; Narracoorte.
Heleocharis multicaulis. Marshy ground, Lake George.
Scirpus cartilagineus. Lake George; Mount Gambier.

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Scirpus pungens. Lake George.
Scirpus lacustris. Mount Graham; Lake Leake; Mount Gambier.
Schœnus nitens. Lake George; Mount Graham; Narracoorte Plains.
Cladium Mariscus. Mosquito Creek.
Cladium articulatum. Mosquito Creek.
Cladium filum. Glenelg River; Riddoch Bay; Lake Bonney; Mosquito Creek; Lake George; Yallum; Narracoorte.
Carex Gunniana. Glenelg River; Cape Northumberland; Mount Graham.
Carex pseudo-cyperus. Mount Graham and towards Mount McIntyre.
Carex breviculmis. Mount Graham.
Agrostis quadriseta. Mount Burr.
Echinopogon ovatus. Cape Northumberland; Glencoe Cave.
Eragrostis Brownii. Narracoorte.
Poa syrtica. Kingston.
Bromus arenarius. Cave Range.
Danthonia nervosa. Sphagnum bog near Mount McIntyre.
Neurachne alopecuroides. Cave Range.
Lepturus incurvatus. Lacepede Bay; subsaline plain, Narracoorte.
Ophioglossum vulgatum. Mount Graham.
Pteris arguta. Cave four miles west from Yallum, Penola.

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List of some Plants inhabiting the North-Eastern part of the Lake Torrens Basin.

By Professor Ralph Tate, F.G.S., F.L.S.

[Read October 1, 1883.]

The region, which I examined botanically during two weeks in each of the months of June and September of this year, embraces the southern half of the Aroona Range and the plain extending therefrom to the shore of Lake Torrens. The Lake Torrens Plain is here bounded at the distance of about 25 miles from the lake by a range of hills, commencing in the latitude of Beltana and following a north-west course through Mount Deception, Mount Scott, Aroona Mountain, Mount Parry, Termination Hill and Mount Nor'-West. This elevated region, which I name the Aroona Range, is west of and divergent from the Flinders Range; its western flank is constituted of clay slates, quartzites and quartzose sandstones, dipping easterly; to the eastward limestones are intercalated, and the whole finally concealed by the drifts which occupy the synclinal valley of Leigh Creek.

The plain of Lake Torrens is at its margin chiefly composed of loams and gravels shed from the adjacent slopes, or transported from the far distant Flinders Range by the torrential streams, which debouch upon the plain; further out, these drifts are concealed by low, more or less parallel, sandhills separated from one another by loamy flats or claypans.

The flora of the basin of Lake Torrens is chiefly known from collections made by Babbage, Lattorf and others at its western and north-western parts; whilst little or nothing is known of the region under review. It belongs to that type of vegetation proper to the "salt-bush" country, such as prevails throughout the dry zone of Central Australia.

The majority of the plants are common to the plain and hills, though the sandhills, after a sufficient rainfall, bloom with a great variety of annuals not met with on the stony ranges.

In the accompanying list, I have given the names of the plants which have not been recorded from the Far North, except those of a few which call for special remarks.

The most noteworthy fact is the presence in this area of many species hitherto not known in South Australia except on the confines of this province towards New South Wales and

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Queensland, and at the MacDonnell Ranges on the verge of the tropics. They have thus been moved, as it were, well within our territorial limits. Of these the following may be especially mentioned: — *Abutilon halophilum*, *Zygophyllum Howittii*, *Ptilotus incanus*, *Euxolus Mitchelli*, *Rhynchosia minima*, *Loranthus Quandang*, *Santalum lanceolatum*, *Oldenlandia tillæacea*, *Millotia Kempei*, *Panicum helopus*, *Eriochloa annulata* and *Chloris truncata*; whilst a few species have been added to our provincial flora, including at least four species new to science. Some critical species, particularly of the genera *Bassia*, *Kochia* and *Atriplex*, remain to be identified.

Myosurus minimus. Claypan near Termination Hill.

Ranunculus parviflorus. Water channels on the slope of Aroona Mountain.

Ranunculus parviflorus var. Lake Weatherstone and claypans near Termination Hill. The same state grows abundantly around the "billibongs" of the River Murray.

Sisymbrium filifolium.. Rocky gullies, Mount Parry.

Sisymbrium procumbens, n. sp. Claypans near Termination Hill.

Sisymbrium trisectum, with yellow flowers. Claypan near Termination Hill.

Erysimum Blennodia. Lake Torrens Plain.

Capsella cochlearina. Lake Torrens Plain and at Hookina.

Lepidium leptopetalum. Rocky gullies, Mount Parry.

Plagianthus glomeratus. On limestone soil between Mounts Parry and Playfair.

Sida (corrugata var.?) pedunculata, Cunningham. Dry water course of Mount Parry Creek.

Sida virgata. By Lake Torrens on sandy soil.

Abutilon halophilum. Depot Creek and Mount Parry Gap.

Hibiscus Krichauffii. By Lake Torrens.

Euphorbia erythrantha. Mount Parry and Lake Torrens Plain.

Phyllanthus rigens. An intricate shrub usually about two but attaining to three feet high, in arid ground with spinescent branches; capsules globular or ovoid, attaining to three lines broad and five lines long; seeds smooth; leaves and young branches with short stiff pellucid hairs. Rocky ground, Mount Parry.

Phyllanthus rhytidospermus? Wet ground at Yadlacena, on Lake Torrens Plain near Mount Parry.

Phyllanthus Fuernrohrii. Sandhills at Ediacara, Lake Torrens Plain.

Parietaria debilis. Among rocks in shady situations, Aroona Range.

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Zygophyllum Howittii. Sandhills, Lake Torrens Plain, chiefly under shelter of shrubs; widely dispersed. Plant prostrate, spreading to one foot or more; radicular leaves, three very large; flowers very small, solitary, axillary and pedunculate; sepals and petals four-merous; sepals ovate, acute; petals yellow, barely exceeding the sepals, obovate, one line long, attenuated into a claw; stamens eight, included; filaments subulate, slightly dilated at the base, but not winged; ripe capsules, indehiscent, red fading to yellow in colour, five lines diameter and six lines long.

Frankenia lævis. Lake Torrens Plain; and stony ground, Aroona Range.

Saponaria tubulosa. By water courses on Lake Torrens Plain; stony hill slopes, Mount Parry.

Spergularia rubra. Lake Torrens Plain.

Portulaca oleracea. Sandy beds of creeks and Lake Torrens Plain.

Claytonia Balonnensis. Sandhills, Lake Torrens Plain, under shade of shrubs.

Claytonia polyandra. With the last.

Ptilotus incanus. Lake Torrens Plain and by Lake Weatherstone.

Ptilotus exaltatus. Mount Parry Gap.

Euxolus Mitchelli. Dry channels of Mount Parry and Depot Creeks.

Alternanthera triandra. Wet margins of Depot Creek.

Rhagodia spinescens. Dry beds of creeks.

Rhagodia parabolica. With the last.

Rhagodia nutans. Mount Parry Creek.

Chenopodium nitrariaceum. On the dry slopes of the Aroona Range, this species has the form of a low intricate bush with very small leaves and spinescent branches. Around Lake Weatherstone, it is a bush about five feet high, with the flowering branches very long, lateral, declinous and spinescent.

Atriplex nummularium. Lake Weatherstone.

Atriplex velutinellum. Lake Weatherstone.

Atriplex Muelleri. Depot Creek.

Atriplex sp. Lake Weatherstone.

Atriplex leptocarpum. Mount Parry Gap.

Atriplex holocarpum. Kanyaka, Wonoka and northward.

Bassia Dallachyana. Mount Parry.

Bassia tricornis. Mount Parry.

Bassia uniflora. Lake Torrens and Mount Parry.

Bassia lanicuspis. Mount Parry.

Bassia biflora. Stony ground, Termination Hill.

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Bassia paradoxa. Mount Parry.
Bassia quinquecuspis. Stony ground, Mount Parry.
Babbagia dipterocarpa. Sandy ground, Lake Torrens Plain.
Babbagia pentaptera. Stony ground, west flank of Mount Parry.
Babbagia acroptera. Mount Parry Gap to Lake Torrens.
Kochia lanosa. Lake Weatherstone.
Kochia fimbriolata. Lake Weatherstone.
Kochia pyramidata. Rocky gullies, Mount Parry.
Kochia eriantha. Lake Weatherstone.
Kochia ciliata. Lake Weatherstone.
Kochia pentatropis, n. sp., aff. *K. triptera*. Limestone soil between Mounts Parry and Playfair.
Aizoon quadrifidum. Sandhills, Lake Torrens Plain.
Aizoon zygophylloides. A prostrate annual, leaves thick, fleshy. On calcareous loam between Mounts Parry and Playfair.
Trianthema crystallina. Stony ground, Mount Parry.
Boerhaavia repanda. About bases of red gum-trees, dry bed of Mount Parry Creek.
Crotalaria dissitiflora var. eremæa. Lake Torrens Plain on sandy ground.
Lotus australis var. Behrianus. Lake Torrens Plain.
Trigonella suavissima. Lake Weatherstone.
Psoralea eriantha. Sandhills at Idyaka by Termination Hill.
Swainsonia phacoides. Lake Torrens Plain.
Rhynchosia minima. Aroona Creek.
Cassia Sophera. Stony ground, Mount Parry.
Cassia desolata. Aroona Range.
Melaleuca glomerata. Beds of creeks in the Aroona Range; Leigh Creek.
Melaleuca parviflora. Aroona Mountain.
Eucalyptus oleosa. Eastern slope of Aroona Range.
Melothria Maderaspatana. Creek beds in the Aroona Range.
Pimelea microcephala. Creeks in the Aroona Range and by watercourses Lake Torrens Plain.
Hakea sp., with foliage of H. purpurea, but with a different inflorescence and fruit. Aroona Mountain and Mount Parry.
Loranthus Exocarpi. Berry orange, turning to red and purple. Aroona Creek.
Loranthus linearifolius. Berry white. Aroona and Mount Parry Creeks.
Loranthus Murrayi. On *Acacia aneura*; sandy ground by Termination Hill.
Loranthus Quandang. Berry green, with thick epicarp. On *Acacia aneura*, Lake Torrens Plain.

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Santalum lanceolatum. Berries black. Mount Parry Gap and to Lake Torrens.
Santalum acuminatum. Margin of creeks and wet ground, Lake Torrens Plain. Pericarp red, succulent.
Santalum persicarium. Stony ground, Aroona Range. Pericarp yellow, rarely red, thin, bitter.
Oldenlandia tillæacea. Wet sandy ground, Lake Torrens Plain.
Minuria denticulata. About all claypans, Lake Torrens Plain.
Minuria integerrima. Idyaka claypan, near Termination Hill—the only known station in the district.
Pterocaulon sphacelatus. Mount Parry and Leigh Creek.
Calotis plumulifera. Lake Torrens Plain and west slopes of Mount Parry.
Pterigeron liatroides. Gullies, Mount Parry.
Epaltes Cunninghamii. Lake Weatherstone.
Centipeda thespidioides. Claypans, Lake Torrens Plain.
Myriocephalus Stuartii. Lake Torrens Plain.
Dimorphocoma minutula. West slopes of Mount Parry and plain adjoining.
Calocephalus platycephalus. Lake Torrens Plain.
Cassinia lævis. Aroona Mountain.
Millotia Greevesii. Margins of drainage channels, Lake Torrens Plain.
Millotia Kempei. Idyaka sandhills by Termination Hill.
Helichrysum podolepideum. Limestone soil between Mounts Parry and Playfair.
Helipterum polygalifolium. Hookina.
Helipterum microglossum. Mount Parry slopes and Lake Torrens Plain.
Senecio Gregorii. Lake Torrens Plain.
Goodenia cycloptera. Sandhills, Lake Torrens Plain.
Goodenia glauca. Mount Parry.
Scævola spinescens. Mount Parry Gap. Leaves $\frac{3}{4}$ to 1 inch long, peduncles nearly twice as long; drupe purple-black.
Scævola humilis. Lake Torrens Plain.
Sarcostemma australe. Lake Torrens Plain. An erect shrub 3 to 4 feet high; never twining.
Marsdenia Leichhardtiana. Twining to a considerable height, chiefly on *Casuarina glauca*. Aroona Range.
Solanum ferocissimum. Shady places, Mount Parry Gap and Depot Creek. Fruit small, globular, changing with age from green to red and black.
Lycium australe. Mount Parry.
Datura Leichhardtii. Beds of creeks, Aroona Range.
Limosella Curdieana. Idyaka claypan by Termination Hill.

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Justicia procumbens. Beds of creeks, Aroona Range. Perennial and erect.
Heliotropium Curassavicum. Around waterholes, Aroona Creek.
Echinospermum concavum. Creeks, Aroona Range and Lake Torrens Plain.
Teucrium racemosum. Mount Parry Gap.
Myoporum montanum. Mount Parry Gap.
Eremophila oppositifolia. Flowers white or pale violet, withering reddish-brown. Mount Parry and Aroona Creek.
Eremophila MacDonelli. A diffuse branching shrub of about one foot high. Lake Torrens Plain.
Eremophila longifolia. Flowers red. Aroona Creek and by watercourses Lake Torrens Plain.
Eremophila Freelingii. Flowers lavender. Aroona Ranges.
Eremophila Elderi. Mount Parry.
Eremophila Duttonii. Flowers maroon. Mount Parry, Aroona Creek.
Eremophila Latrobei. Mount Parry.
Eremophila maculata. Idyaka claypan, by Termination Hill.
Eremophila latifolia. Flowers green. Mount Parry and Aroona Creek.
Wurmbea dioica. Perianth green or yellow. Lake Torrens Plain.
Triglochin centrocarpa. Wet ground, Lake Torrens Plain.
Centrolepis aristata, var. pygmæa. Idyaka, by Termination Hill.
Cyperus exaltatus. Idyaka claypan.
Cyperus vaginatus. Aroona water.
Heleocharis acuta. Idyaka claypan.
Fimbristylis communis. Idyaka claypan.
Panicum reversum. Depot Creek.
Panicum decompositum. Depot Creek.
Panicum helopus. Depot Creek.
Eriochloa annulata. Wet ground, Lake Torrens Plain.
Setaria viridis. Depot Creek.
Lappago racemosus. Lake Torrens Plain and Depot Creek.
Spinifex paradoxus. Sandhills, Lake Torrens Plain.
Aristida stipoides. Mount Parry Gap.
Aristida arenaria. Lake Torrens Plain.
Aristida ramosa. Stony bed of Mount Parry Creek.
Aristida calycina. Stony hill slopes, Aroona Range.
Alopecurus geniculatus. Idyaka claypan.
Stipa scabra. Creeks and rocky places, Aroona Range.
Astrebla pectinata. Mount Parry Gap.
Trirhaphis mollis. Beds of creeks, Aroona Range.
Chloris acicularis. Beds of creeks, Aroona Range.

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Chloris truncata. Mount Parry Gap.
Eleusine cruciata. Lake Torrens Plain.
Eragrostis leptocarpa. Lake Weatherstone, Depot Creek.
Eragrostis laniflora. Mount Parry Gap.
Eragrostis Brownii. Mount Parry Gap and Depot Creek.
Poa ramigera. Lake Weatherstone; claypans, Lake Torrens Plain.
Festuca litoralis. Aroona Mountain.
Diplachne loliiformis. Wet depressions between sandhills of Lake Torrens Plain and on slopes of Mount Parry.
Ophioglossum vulgatum. Lake Torrens Plain and by Lake Weatherstone.
Grammitis rutæfolia. Mount Parry and Aroona Mountain.
Cheilanthes vellea. Mount Parry and Aroona Mountain.

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Diagnoses of some New Plants from South Australia,

By Baron Sir F. von Mueller, M.D., F.R.S. &c. and Professor Ralph Tate, F.G.S., F.L.S. &c.

[Read August 7, 1883.]

Dimorphocoma.

Flower-head nearly bell-shaped. Bracts forming the involucre nine or ten, herbaceous, in two rows, narrow-lanceolate. Receptacle without special bracts. Flowers few. Corolla of the outer flowers radiating with short and narrow ligules; stamens none; style enclosed; stigmas exceedingly thin, rather acute. Innermost flowers bisexual, very few in number; corolla tubular, with five short tooth-like lobes; anthers very short, rounded at the base; stigmas very thin, papillular. Achenes of the anantherous flowers fertile, obconic-oblong, densely silky; their pappus consisting of numerous capillary bristles in several rows unequal in length, and of five or six linear-lanceolate inner scales. Achenes of the bisexual flowers exceedingly slender, glabrous; their pappus formed by a few very short bristles.

A minute annual of Central Australia, having much the aspect of *Vittadinia australis*, with short hairs, with oblong- or narrow-lanceolar leaves at the base and along the stem, with terminal solitary small flower-heads almost sessile or on short peduncles, and with whitish rays of the outer flowers.

The genus, thus defined, differs chiefly from *Elachanthus* and *Isoetopsis* in its anantherous flowers being ligulate, and in having the pappus of the fertile fruits provided not only with scales, but also with bristles; from *Isoetopsis* it is furthermore distinct in habit; from *Minuria* it is separated by its fewer and broader involucral bracts, and by its anantherous flowers producing a scaly as well as bristly pappus.

Dimorphocoma minutula.

On barren stony ground, forming the western slope of Mount Parry, in the Aroona-Range, towards Lake Torrens. *R. Tate.*

The specimens vary from one and a-half inch to four inches high, beset with septate hairs. Stems one or two or few, erect or ascending. Root very thin, attaining a length of three and

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a half inches, producing scattered capillary fibres. Leaves flat, a half to one inch long; the radical leaves somewhat shorter and broader than the others, the uppermost narrower than the rest. Flower-heads about one-fourth of an inch long. Involucral bracts nine or ten, the inner not much longer than the outer. Anandrous flowers eight or nine; their ligular portion white, hardly exceeding one line in length, undivided and acute. Bisexual flowers three or four; their corolla yellow, only about one-eighth of an inch long, gradually widening upwards. Fertile achenes nearly one and a half line long, truncated at the summit; their scales whitish and equal in length to the longer bristles, which measure about one and a half line. Sterile achenes with bristles of hardly one-fourth of their length.

In flower during the early part of June, but continuing to September.

[Read October 2, 1883.]

Babbagia pentaptera.

A small undershrub, with diffuse procumbent branches and numerous ascending branchlets; leaves short, club-shaped or linear semi-cylindrical, glabrous and succulent; flowering calyces somewhat downy; style very short; stigmas two; fruits streaked along their exceedingly short tube, only slightly excavated at the base, angular from five very spreading stiff prominences, and provided with five deltoid wedge-shaped vertical imperfectly denticulated wing-like membranes, yellowish, tinged with pink; seeds very depressed.

On barren stony ground, on the western slope of Mount Parry, in the Aroona Range. *R. Tate.*

This new *Babbagia* differs from its congener chiefly in its fruit, the base of which is very much less protracted cylindrically, and the wing-like appendages being five in number, almost dimidiated and at least slightly toothed. Through this new plant a close connection is established between *Babbagia* and *Kochia*, more particularly so, as *K. dichoptera* has besides its horizontal fruit-membrane also five vertically-ascending appendages. To some extent *Babbagia* approaches also *Bassia* through *B. salsuginosa*, although the fruits are less hard and five-winged.

Babbagia acroptera.

Leaves oblong-semicylindrical; fruit-calyx above the tubular base turgid, thence produced into two oblique-roundish or broad-cuneate completely terminal and conspicuously stipitated membranous appendages.

On loamy soils, from the slopes of the Aroona-Range to Lake Torrens. *R. Tate.* Near Mount Murchison, *Dr. Beckler;* between Stokes Range and Cooper's Creek, *Howitt.*

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This plant seems specifically distinct from *B. dipterocarpa* in the characteristics of its fruit, as the hollow base of the aged calyx is not so wide, as the appendages are neither renate nor half-ascending, stronger stipitated and gradually narrowed at their lower portion; one of the two appendages is usually not so well developed as the other. The peculiarities of this new form, as here pointed out, do not depend on an imperfect ripening of the fruit, as the seeds may be seen well matured.

In Sir Joseph Hooker's "Icones Plantarum," xi. 62, pl. 1,078, fruits of both species are illustrated, figure 5 representing that of *B. acroptera* and figure 6 that of *B. dipterocarpa*. Both plants occur in the vicinity of Mount Parry, though the latter is somewhat local; but what we have from the Finke River and from Eyre Creek is solely *B. dipterocarpa*. An approach is offered by *B. acroptera* to the section Osteocarpum of Bassia.

Loranthus Murrayi.

Glabrous; leaves alternate, semiterete, slender, veinless, not exceeding two inches in length, somewhat attenuated at the base; flowers mostly solitary, sometimes in pairs, on flattened, shortly winged pedicels of about half an inch long, without a common peduncle; bract unequally bilobed, conspicuous, decurrent on the pedicel; calyx-tube prominent, glaucous, its border truncate and obscurely toothed; petals usually six, about ten lines long, united to about the two-thirds of their length into a slightly dilated tube; corolla-tube pale yellow; segments linear-lanceolate, yellow below, pale rose above; stigma capitate; style and filaments brown, anthers adnate, broadly linear; unripe fruit globular, glaucous.

Parasitic on *Acacia aneura*, on sandy ground at Idyaka, near Termination Hill. *M. Murray* and *R. Tate*.

This species was first brought to notice by Malcolm Murray, Esq., whose kind hospitality and active promotion of the field labours of one of us have been the means of introducing to botanical science several new species; it is, therefore, with very great pleasure that we dedicate to him this new Loranthus.

L. Murrayi is closely related to *L. linearifolius* differing, however, in several minor particulars, and is separable from it and from its congeners by the peculiarity of the pedicel.

Corrigendum.

Vol. v., pp. 80 and 87, for Trymalium *Wayæ* read *Wayii*.

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Additions to the Flora of South Australia.

By Professor Ralph Tate, F.G.S., F.L.S., &c.

[Read October 2, 1883.]

The publication of Baron Sir F. von Mueller's "Systematic Census of Australian Plants, Part I., Vasculares," has brought to notice the occurrence of several plants hitherto unrecorded for South Australia; for these Baron Mueller has obligingly furnished localities. A few species included in the subjoined catalogue had been omitted from my "Census of South Australian Plants" because their claims to rank as indigenous constituents or as species, respectively, were at that time not conclusively established. The rest of the enumerated species are more recent accessions to the provincial list, and their identifications have been made or approved by Baron Mueller. The nomenclature herein used is adopted from the "Systematic Census;" from that work and manuscript data supplied by Baron Mueller I have compiled the following tables of comparative statistics:—

Table showing total number indigenous in Australia and in each colony.

	Dicotyledons.	Monocotyledons.	Acotyledons.	Totals.
Australia	6,916	1,524	228	8,668
West Australia ..	2,847	537	17	3,401
South Australia ..	1,401	382	36	1,819
Tasmania ..	691	268	66	1,025
Victoria	1,286	417	79	1,782
N. S. Wales ..	2,301	652	138	3,091
Queensland ..	2,382	715	178	3,275
N. Australia ..	1,390	394	32	1,816

Total species restricted to each colony.

	Dicotyledons.	Monocotyledons.	Acotyledons.	Totals.
West Australia ..	2,203	345	0	2,548
South Australia ..	134	13	1	148
Tasmania ..	144	22	6	172
Victoria	44	6	0	50
N. S. Wales ..	362	74	15	451
Queensland ..	728	155	62	945
N. Australia ..	590	113	3	706

The ratio of the Monocotyledons to the Dicotyledons is for the whole flora 1 : 4·53, and is considerably greater than that for these classes of the world's vegetation; this is attributable

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to the high ratio for West Australia, which is 1 : 5·3. The relative proportions of the species of the two classes is for South Australia 1 : 3·7, for New New South Wales and North Australia 1 : 3·5, and for Queensland 1 : 3·3; falling to 1 : 3 for Victoria and 1 : 2·6 for Tasmania.

The percentages of peculiar species for each colony are:—

West Australia	...	74·86
North Australia	...	38·8
Queensland ...	...	28·78
Tasmania ...	...	16·8
New South Wales	...	14·21
South Australia	...	7·82
Victoria ...	...	2·8

The schematic form of the "Systematic Census" affords at a glance the regional distribution of the species; and it will not escape notice of the analytical reader that the initial letters S.A. are wanting to bridge over a hiatus in the longitudinal range of a few species. Thus there are 21 which are common to extratropical parts of West Australia and corresponding regions on the east side of continent, but are absent from South Australia Of these, which are not maritime species of intratropical origin, the following may be expected to occur within the boundaries of our province:—

1. Species unrecorded for South Australia, though probably inhabiting the more humid parts of the province:—*Ranunculus hirtus, Bossiæa cordigera, Calocephalus angianthoides, Stypandra glauca, Scirpus arenarius, Chorizandra cymbaria, Isoetes Drummondii* and *Phylloglossum Drummondii.*

2. Species unrecorded for South Australia, though probably inhabiting the arid regions of this province, towards the Tropic of Capricorn:—*Cassytha racemosa, Dodonæa adenophora, Psoralea cinerea, Canavalia obtusifolia, Acacia ixiophylla, Xanthosia Atkinsoniana, Lambertia formosa, Conospermum stœchadis, Cucumis trigonus, Lindernia (Vandellia) alsinoides, Lippia nodiflora, Andropogon contortus* and *A. Halepensis.*

The following species recorded for South Australia in the Systematic Census of Australian Plants are omitted, for the present, by the advice of Baron Sir F. von Mueller, as their occurrence within South Australian boundaries wants confirmation:—*Stenopetalum robustum, Hibiscus Huegelii, Securinega Leucopyrus.*

Hibbertia hirsuta, Bentham in Fl. Aust. I., 26. Sandy ground by margin of alluvial flats in the valley of Meadows Creek. *Tepper* and *Tate.*

Capparis lasiantha, R. Brown; I., 94. Cooper's Creek. *Gregory.*

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Bergia perennis, F. v. M.; I., 181. Near the River Finke, Central Australia. *Rev. H. Kempe.*

Beyeria uncinata, F. v. M.; VI., 65. Murray Scrub near the Great Bend. *F. v. Mueller.*

Phyllanthus rigens, J. Mueller; VI., 99. Aroona Range, Far North. *R. Tate.*

Phyllanthus australis, J. Hooker; VI., 108. Kangaroo Island. *R. Tate.*

Babbagia pentaptera, F. v. M. and Tate. Mount Parry, Aroona Range. *R. Tate.*

Babbagia acroptera, F. v. M. and Tate. Lake Torrens Plain, by Aroona Range.

Rhagodia Preissii, Moquin; V., 155. About the head of the Great Australian Bight. "Eucla, *Richards*; between Ooldea and Ooldabinna, *Young*;" Mundayarra sand-patch, east from Wilson Bluff. *R. Tate.* "Yorke Peninsula. *Salmon.*" See Frag. Phyt. xii., 15.

Emex australis, Steinheil; V., 262. Near Adelaide and Holdfast Bay. *F. v. M.* in Fl. Austral.

Herniaria incana, Lamarck. Moist sandy ground by the Murray River, near Blanchetown, and at Aroona Water, Far North. *R. Tate.*

This species "has, as an indigenous plant, a wide range through the countries around the Mediterranean area, and has found its way also to South Africa. If it was a native with you, I should think we must have traced it like *Cressa cretica*, and some other Mediterranean plants, across from N.W. Australia. Nothing would be easier than the introduction of such a weed by emballage." —F. von Mueller *in litteris.* The genus is unrepresented in the Australian Flora, and to me it is difficult, in view of its environments and stations, to account for its introduction.

Æschymomene indica, Linnè; II., 27. Charlotte Waters, Central Australia. *C. Giles.*

Tephrosia sphærospora, F. v. M. in "Southern Science Record," May, 1883. Near the River Finke, Central Australia. *Rev. H. Kempe.*

Acacia Peuce, F. v. M.; II., 323. N. of Wills Creek. *Howitt's Exped.* in Fl. Austral.

Acacia cochlearis, Wendland; II., 324. Port Lincoln. Fide *F. v. M.*

Acacia aspera, Lindley; II., 347. Murray River. Fide *F. v. M.*

Acacia pyrifolia, DeCandolle; II., 376. Finke River. *Rev. H. Kempe.*

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Acacia pravifolia, F. v. M.; Frag. Phyt., I., 4. Crystal Brook, Flinders and Elder Ranges. *F. v. M.*

Acacia trineura, F. v. M.; II., 381. Murray River. Fide *F. v. M.*

Acacia cyclops, Cunningham; II., 388. Near Eucla. *Oliver.*

Acacia doratoxylon, Cunningham; II., 403. Near Cooper's Creek. Fide *F. v. M.*

Eucalyptus amygdalina, Labillardiere; III., 202. Nangwarry Forest and Tarpeena. *J. E. Brown* and *R. Tate.*

Hydrocotyle tripartita, R. Brown; III., 341. Kangaroo Island. *R. Tate.*

Loranthus Murrayi, F. v. M. and R. Tate; Trans. Roy. Soc., S. Aust., vol. vi. Idyaka near Termination Hill in the Aroona Range. *M. Murray* and *R. Tate.*

Brachycome melanocarpa, Sonder and F. v. M.; III., 511. River Murray. *F. v. M.*

Aster exiguifolius, F. v. M.; III., 478. Bunda Cliffs, Great Australian Bight, *R. Tate*, 2-'79; Fowler's Bay; *Mrs. Annie Richards*, 10-'80.

Epaltes Tatei, F. v. M., Trans. Roy. Soc. S. Aust., 1883. East side of Lake Alexandrina, *R. Tate*; vicinity of Spencer Gulf, *F. von Mueller.*

Eriochlamys Knappi, F. v. M.; "Melbourne Chemist," May, 1883. Near the River Finke, Central Australia. *Rev. H. Kempe.*

Calocephalus Drummondii, Bentham; III., 574. Port Lincoln. *S. Dixon.* The *Gnephosis skirrophora* in the geographic columns *c* and *d* in Census of S. Aust. Plants belongs here—Ardrossan. *Tepper.* Scrub-lands at Inkermann, Munno Parra, and at Highbury; stony hill slopes, Fifth Creek, near Adelaide; and scrub-lands at east side of Lake Alexandrina. *R. Tate.*

Achnophora Tatei, F. v. M.; Trans. Roy. Soc. S. Aust., 1883. Kangaroo Island. *R. Tate.*

Dimorphocoma minutula, F. v. M. and Tate; Trans. Roy. Soc. S. Aust., 1883. Mount Parry, Aroona Range. *R. Tate.*

Senecio spathulatus, A. Richard; III., 665. MacDonnell Bay. *F. v. M.*

Senecio australis, A. Richard; III., 668. Near the Glenelg River. *F. v. M.*

Lobelia platycalyx, F. v. M.; IV., 133. Kangaroo Island. *R. Tate.*

Goodenia elongata, Labillardiere; IV., 74. Near the Glenelg River. *F. v. M.*

Samolus platyphyllus, F. v. M., in "Systematic Census," p. 91. Finke River. *Rev. H. Kempe.*

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Mitrasacme pilosa, Labillardiere; IV., 353. Mount Burr Range. *R. Tate.*

Mitrasacme distylis, F. v. M.; IV., 359. Clarendon. *O. Tepper.*

Solanum nigrum, Linné; IV., 446. Mount Lofty, *F. v. M.*; Kangaroo Island, *Waterhouse, Tate*; cultivated grounds in the South-East, *Rev. J. E. T. Woods*; waste places about Adelaide, Mannum and other stations on the River Murray; Ediowie, Far North, *R. Tate*; Ardrossan, *Tepper.*

Thelymitra Mackibbinii, F. v. M.; "Melbourne Chemist," 1881. *T. rubra*, Fitzgerald, in "Gardeners' Chonicle," 1882, which was instituted on South Australian specimens, is referred to the above by Baron F. von Mueller (*vide* "Southern Science Record," June, 1882). Sandy scrub-lands at Highbury near Adelaide, and Tintaro, Maclaren Vale; stony ground on the higher parts of the Mount Lofty Range. *R. Tate.* Yallum, near Penola (*Miss Allen!*).

Diuris punctata, Smith; VI., 326. Near the Glenelg River. *F. v. M.*

Prasophyllum australe, R. Brown; VI., 337. Near the Glenelg River. *F. v. M.*

Damasonium australe, Salisbury; VII., 186. Near Strathalbyn. *F. v. M.*, 4-'48. Marshes by River Murray at Mannum. *R. Tate.*

Juncus homalocaulis, F. v. M.; VII., 128. Near the Glenelg River. *F. v. M.* (1857).

Restio complanatus, R. Brown; VI., 228. Near the Glenelg River. *F. v. M.*

Kyllinga intermedia, R. Brown; VII., 251. River Torrens. *F. v. M.*, in 1848.

Heleocharis acicularis, R. Brown; VII., 297. River Murray. *F. v. M.*

Fimbristylis ferruginea, Vahl; VII., 312. River Finke, Central Australia. *Rev. H Kempe.*

Fimbristylis Neilsoni, F. v. M.; VII., 320. Near the Darling River. Teste *F. v. M.*

Schœnus aphyllus, Boeckler; VII., 361. River Murray near the Great Bend. *F. v. M.*

Schœnus deformis, Poiret; VII., 364. Memory Cove, Port Lincoln. *R. Brown*, in Fl. Austral.

Schœnus capillaris, F. v. M.; VII., 377. Near the Glenelg River. *F. v. M.*

Schœnus sphærocephalus, Poiret; VII., 380. Mount Burr Range. *R. Tate.*

Lepidosperma exaltatum, R. Brown; VII., 389. Near the Glenelg River. *Robertson* and *F. v. M.*

Lepidosperma longitudinale, Labill.; VII., 389. Near the Glenelg River. *F. v. M.*

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Lepidosperma globosum, Labill.; VII., 394. Near the Glenelg River. *F. v. M.*

Cladium Radula, R. Brown; VII., 417. Mount Burr Range. *R. Tate.*

Panicum Crus-Galli, Linné; VII., 479. Near Hahndorf (probably introduced). *F. v. M.* Reedbeds near Adelaide. *R. Tate.*

Panicum Mitchelli, Bentham; VII., 489. Cooper's Creek. *Howitt's Exped.* (Fl. Austral.)

Andropogon exaltatus, R. Brown; VII., 532. R. Torrens, Crystal Brook, Flinders Range, *F. v. M.*; and Lake Eyre, *Andrews* (Fl. Austral.). Aroona Range and Lake Torrens Plain. *R. Tate.*

Stipa teretifolia, Steudel; VII., 567. On rocks at high water-mark, north coast of Dudley Peninsula, Kangaroo Island. *R. Tate.*

Alopecurus geniculatus, Linné; VII., 555. Spencer and St. Vincent Gulfs to the River Murray, *F. v. M.*, in Fl. Austral. Near Penola, *Rev. T. Woods.* Claypans on Lake Torrens Plain, by Aroona Range, *R. Tate.*

Poa Billardieri, Steudel; VII., 651. Near the Glenelg River. *F. v. M.*

Festuca duriuscula, Linné; VII., 663. Flinders and Barossa Ranges. *F. v. M.*, in Fl. Austral.

Eragrostis eriopoda, Bentham; VII., 648. Towards the Darling River. Teste *F. v. M.*

Lycopodium Carolinianum, Linné; VII., 675. Bogs about Mounts Compass and Jagged. *R. Tate.*

Botrychium ternatum, Swartz; VII., 690. Kangarilla near Clarendon. *O. Tepper.*

Pteris arguta, Aiton (*P. tremula*, R. Br.); VII., 731. Rocky waterhole five miles back from Streaky Bay. *Mrs. A. Richards.* Limestone cave about eight miles from Penola on the road to Millicent and near Glencoe. *R. Tate.*

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The Botany of Kangaroo Island,

Prefaced by a Historical Sketch of its Discovery and Settlement, and by Notes on its Geology,

By Professor Ralph Tate, F.G.S., F.L.S. &c.

[Read August 7, and September 4, 1883.]

Introduction.

The large size of Kangaroo Island suggests the question, has it that amount of geographical independence which suffices to produce a flora and fauna different from those of the mainland? In other words, are its floral and faunal constituents distinct from the inhabitants of the adjacent continent? With the exception of the flora little has been done to elucidate the natural history of the island, though some of its animal species are diagnostically known, yet I am not aware if any other than a few conspicuous species have been recorded from the mainland; at any rate, no systematic comparison has been undertaken. In respect to its flora the case is different, as also that of the continent; botanical records have been more systematic, and in consequence the botanical geography of Australia is very far in advance of its zoological geography. Formerly, authors were content to speak of animal objects as coming from New Holland or Australia; and even now when localities are given, it not infrequently happens that they are widely inaccurate, so that it is, at the present time, hardly possible to elaborate zoological provinces, or to bring into co-ordination animal colonies with well-defined climatological and botanical features.

I am sorry to say that no help can be obtained from the South Australian Museum in working out the question, has Kangaroo Island any peculiar species of animals? And the Herbarium of our Phytologic Museum is similarly valueless as concerns botanical information.

It may be mentioned incidentally, that there does not exist any connected account of the zoology of the island as resulting from the observations or collections made by Mr. Waterhouse, who spent there some months of the year 1861, in making collections by command of the South Australian Government. Some longicorn beetles would seem, however, to have fallen

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into the hands of Mr. Pascoe*, who described two species. Peron† made large collections during a month's stay at the island, and has given us a general view of its animal inhabitants, both of sea and land. A few of the insects are described by Boisduval; some reptiles by Gray and Dumeril; and the marine shells by Lamarck in his "Animaux sans Vertebrès."

Historical Sketch of the Discovery and of the Progress of Occupation of the Island.

Kangaroo Island was discovered by Flinders‡ during his survey of the southern shores of the continent. Coming from the westward, he sighted the north coast of the island on March 21, 1802; made for the most northern promontory, which he named Port Marsden, and anchored off Kangaroo Head. The next day a party of the ship's company landed to procure a supply of fresh meat, which was abundantly furnished by numerous kangaroos, and "in gratitude for so seasonable a supply, I named this southern land Kanguroo *(sic)* Island." The ship remained at its anchorage until March 24, but returned April 1. On this second visit a party explored Pelican Lagoon, and traversed the narrow isthmus which connects Dudley Peninsula with the main mass of the island. Flinders says very little about the natural features, but references will be made in their proper connection. A final leave was taken on April 6, and on the 8th of the same month Flinders met his rival, Captain Baudin, commanding the French corvette Le Geographe, in Lacépède Bay, and communicated to him, among other discoveries, that of Kangaroo Island.

The island, which was sighted by Baudin on April 9, was named by him Decrès Island. On this voyage, it would appear, that he only skirted the north coast, on his way through Investigator's Straits to the Great Australian Bight; as the author§ of the narrative of the expedition writes:—"The geography of Decrès Island was not complete—gulfs not explored. A second campaign to this region was then still indispensable" (loc. cit., I., p. 332).

On January 2, 1803, Baudin commenced the circumnavigation of the island, starting from Cape Willoughby, its eastern extremity, by the south coast, naming the capes and bays—most of which are still known by their original names—and on January 6 anchored in Nepean Bay, off Kingscote. Here a

* "Journal of Entomology," II., 1863.

† "Voyage de Decouvertes aux Terres Australes," vol. ii., pp. 76-83.

‡ "A Voyage to Terra Australis," 1814.

§ F. Peron, "Voyage de Decouvertes aux Terres Australes, sur les Corvettes le Geographe et la Naturaliste, 1800-4." Vol. i., 1807; vol. ii., 1816.

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portion of the expedition remained nearly a month, and the members of the scientific staff occupied themselves in investigating the natural productions, though it is evident that no attempt was made to penetrate beyond the immediate vicinity of the shore line, else Cygnet River would most certainly have been discovered. Peron remarks, that this island appeared almost entirely wanting in fresh water, and it was only near to the close of the circumnavigation that water was obtained by digging wells at the east side of Hog Bay, which circumstance is recorded on the surface of a slab of mica slate, which also marks the site of a well. The inscription was imperfectly legible when I saw it in 1878.

Peron's account of the natural history and physical features of the island is not only graphic, but rich in details, and occupies many pages of his second volume. It remains to this day the only published general description of the island.

Flinders and Peron have each remarked on the absence of any trace of man's sojourn on the island.

After Baudin, the next visitor to the island was Captain Sutherland, who published in 1819 "glowing and exaggerated accounts of it." So writes John Stephens ("History of the Rise and Progress of South Australia," p. 26; 1839).

The first extensive settlement was by the South Australian Company, who had selected 300 acres for their establishment, and by virtue of which they leased 5,120 acres of pasturage. The Company contemplated the salting and curing of beef and pork, and the pursuit of whale, seal, and other fisheries. They fixed a station at Kingscote for the re-victualling and re-fitting of their ships, and worked a farm on the Cygnet River, nine miles off. During 1836 and 1837 several ships discharged the Company's servants and emigrants at Kingscote; but the great bulk of the emigrants shortly afterwards proceeded to Adelaide, leaving some of the Company's people to retain a settlement on the island. (Abridged from Stephens's "History of South Australia," 1839.)

Settlement on a small scale had, however, taken place many years before by sealers and runaway sailors, who cultivated a little wheat, potatoes, turnips &c., but subsisted largely by sealing and kangaroo hunting—the skins being sold or exchanged to whalers. One settler on the Cygnet River had been there since 1824; a party had settled at Western River about 1827, and resided there several years; and another at American River prior to 1836. These primitive settlers had living with them a few aboriginals, whom they had induced to follow them from the main.

According to the testimony of Inspector Tolmer (see his "Reminiscences," &c., 1882), Kangaroo Island, in the year

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1844, was an asylum for the offscourings of Australian society, including escaped convicts and deserters, with whom were aboriginal women from Tasmania, Port Lincoln and Cape Jervis, earning a precarious livelihood by hunting and a little cultivation. From the same author we gather that in 1844 there were residents at Hog Bay, Point Morrison and Antechamber Bay, in addition to those previously mentioned.

The first pastoral leases were granted in 1851, and comprised twelve square miles at Cygnet River and six at Smith's Bay. Since this date nearly the whole island has gradually been brought into use for sheepfarming on a small scale; but it was not till 1882-3 that any large importation of sheep took place, when Messrs. Taylor & Co. stocked their runs in the south-western parts of the island with sheep brought from the Mount Gambier district.

The first land sales were made 15 years after the foundation of the settlement at Kingscote, and purchases of small blocks averaging 100 acres continued to be made for the next 20 years.

At and near Kingscote 468 acres were purchased during the years 1851-8; at Cygnet River, 1,087 acres during 1851-71; at Shoal Point, 127 acres during 1855-58; about Hog Bay, 1,068 acres during 1857 to 1863.

By proclamation 13th August, 1874, the Hundred of Dudley, comprising 21,975 acres, was offered for selection, and the first selection was taken out September 19, 1876. On April 11, 1878, the Hundred of Menzies was proclaimed, and 37,302 acres offered for selection, and the first sales were made January 24, 1882. On May 10, 1883, the Hundred of Haines, embracing the south shore of Nepean Bay, was proclaimed, but the land has not yet been offered for sale.

Surface Features.

Of all islands belonging to the Australian system, Kangaroo Island is the second in point of size; it is of an oblong shape, attenuated in its eastern third into the Peninsula of Dudley; the longer diameter, which is nearly due east and west, is 90 miles; the breadth of the main mass is about 25 miles, and of the peninsular portion ten miles; and its circumference is not less than 300 miles. Its area is about 1,500 square miles.

Kangaroo Island bridles the deep indentation of the main known as St. Vincent Gulf, and is separated from the Cape Jervis Promontory by Backstairs Passage, which is eight miles wide at its narrowest part; the other entrance to St. Vincent Gulf is Investigator's Straits, which is 28 miles broad at the narrowest part between Cape Spencer, on Yorke Peninsula.

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The whole of the south side is exposed without protection to the impetuous waves of the vast Southern Ocean.

In regard to the surface features the only author who has occupied himself with them is Peron, and as his observations in relation to the littoral tracts are the most extensive, I reproduce them here. He says Kangaroo Island "does not present, despite its great extent, any form of mountains properly so-called; the entire framework of the country is composed of hills more or less elevated, but of which the summits are nearly everywhere regular and uniform. All the length of the south coast its cliffs are developed upon a single plan from 200 to 300 feet high, sloping inland, but presenting to the sea a perpendicular front surrounding it as a rampart. Their colours are sombre, and vary from grey to brown, or even blackish; where least so they are of a yellowish ochre or more or less dirty. From Cape Bedout to the Ravine des Casoars the rocks present the same appearance as those on the south coast, but are higher; and though they are deprived of all kinds of trees, yet the interior cliffs are seen to be wooded. The north coast is arid and naked as that of the south, and exhibits everywhere a similar constitution. The shores of Bougainville [Nepean] Bay are formed of low cliffs, but the verdure which covers them and the forests which grow on the heights give to this part a more pleasing and agreeable aspect. Such appears to the eyes of the circumnavigator the greatest island of New Holland; however, the view pictured with rigorous exactitude for its shores might have doubtlessly become more interesting and more varied had it been possible to penetrate into the interior of the country."

The picture drawn by Peron is not at all exaggerated, and the interior is alike marked by uniformity of a rather cheerless type. The country is undulating, not at all rangy; the northern half is elevated, rising from the coast in bold cliffs; the southern half gradually sinks to near sea level, but is margined by hills of consolidated sand-dunes, which rise to considerable elevation—Mount Bloomfield and Mount Mary, at Vivonne Bay, are respectively 272 and 224 feet.

The chief watershed is nearly longitudinal and supra-medial —commencing near Cape Borda, and with a slight southerly curve, changing to north, to terminate in the sea cliffs from Point Morrison to American River. It is continued into Dudley Peninsula, which it traverses in a medial direction. The aspect of this elevated ground is of the most modest type, and is apparently of about the same altitude throughout, probably nowhere exceeding a thousand feet.

To the north of the main watershed there is a minor one, which follows the trend of the coast from Kingscote to Cape

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Borda. Part of it, called the Freestone Range, is by contrast with the rest of the island bold and picturesque, and is clothed with timber. Mount McDonnell is 984 feet elevation; from this point the general elevation falls to the westward, though the heights by the sea coast still maintain considerable altitude, such as between Middle and Western Rivers at 658, Cape Forbin 560, Cape Borda 506. Between the two watersheds there intervenes the valley of the Cygnet River, which, after a course of 40 miles, enters Nepean Bay. It has its source in several large lagoons. Excepting the Stun'sail-boom and rivers to the westward of it, none of the watercourses on Kangaroo Island are perennial.

Geology.

From personal observation, I classify the rocks as indicated by the subjoined table:—

Tertiary.

1. Recent sand-dunes. Lacustrine deposits.
2. Pleistocene. Calciferous sand-rock of the south coast and marine beds.
3. Pliocene. Pluvial drifts.
4. Miocene. Bryozoal limestone of Roll's Point.

Palæozoic.

5. Diorite and intrusive granite.
6. Pre-silurian schists and associated strata.

Peron had notified the presence of No. 6, No. 4, No. 1 and No. 2, about which last he devotes several pages to the consideration of its origin, and that of the petrified remains entombed in it.

Mr. Brough Smyth, in his Geological Map of Australia, 1875, colours Kangaroo Island to represent Tertiary, except the eastern half of Dudley Peninsula, which is shown as Silurian. I know not whence he derived his information, but, like that for much of our province, it is very erroneous. Had Peron been consulted, such adverse criticism would have been uncalled for.

Pre-Silurian Schists.—As correctly observed by Peron, Kangaroo Island "is composed essentially of different kinds of primitive schists, between which are found some veins of opaque quartz. All the eastern part of Bougainville Bay [Nepean Bay] is principally composed of a red and very hard ferruginous sandstone; it is to this singular rock that Kangaroo Head, Cape Geographe, Red Cape and Vendome Cape owe the reddish and sombre tint which distinguishes them from afar. A primitive sandstone, quartzose and very compact, forms some parts of the coast." The prevailing rock is a mica schist, which is displayed in magnificent sections along the north coast of

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Dudley Peninsula, about American River, Point Morrison, Bay of Shoals, and to the westward along the north coast. From Cape Willoughby to Antechamber Bay, it is associated with gneiss and [metamorphic?] granite; and the almost vertical stratification is rendered visible at the distance of some miles by the alternation of the diversified coloured massive beds.

The prevailing dip of the strata on the north-west coast of Dudley Peninsula is south-east, and the same direction is observable in the micaceous beds of the gorge of the Hog Bay River.

At Christmas Cove and extending westward towards Kangaroo Head along the shore-line, there are intercalated bands of angular and subangular pebbles, chiefly of quartzite, and in the aggregate of many feet in thickness; the pebbles varying in size from six inches in diameter to small gravel, and their bedding planes are coincident with the plane of foliation. These rocks are comparable with those constituting the Cape Jervis Promontory, though no crystalline limestones are here developed, and are doubtlessly coeval with them. Mica slate constitutes the bold inland cliffs on the Hog Bay River, about two miles from its mouth; and it also forms the base of an unnamed cape, three miles to the west of the mouth of that river. Most of the headlands on the south and west coasts are composed of, or are based upon, granite, but whether of metamorphic or intrusive origin cannot definitely be ascertained; yet the presumptive opinion is that it forms part of the metamorphic series. Such formation constitutes Cape Willoughby, Cape Gantheaume, Pelorus Islet, Cape Du Couedic, Cape Borda, &c. Inland the exposures of mica slate are not frequent, because of the widespread covering of superficial detritus, derived from the mica slate and associated micaceous sandstones, more or less in place. However, they are sufficiently numerous to place beyond doubt that the greater part of the island is constituted of this rock. Among the more extensive outcrops may be mentioned those near Birchmore's and White Lagoons, the ridge separating the latter from Murray's Lagoon, and the beds of the Harriet and Stun'sail-boom Rivers.

Igneous Rocks.—A white granite, apparently intrusive, is quarried near Karatta, on the Stun'sail-boom River. A diorite seems largely to have determined the direction of the elevated ground known as Freestone Hill Range.

Miocene.—Forming a low mural cliff at Roll's Point, Kingscote, is a bryozoal limestone, similar in structure and of the same age as that of the cliffs about Oyster Bay, Yorke Peninsula. Among the common fossils, proper to this particular formation of this period, *Echinolampas Gambierensis* is noteworthy. The deposit is continued along the shore for about a

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mile south of Roll's Point, and inland is traceable over a limited area by the presence of a white travertine limestone crust, chemically deposited from the underlying organic limestone. Both these formations are evidently referred to by Peron in the following passage:—"At many points of Bougainville Bay there occur two kinds of calcareous rocks; the one harder in the grain, of a more homogenous nature, approaching in nature some sandstones; the other more like chalk. These calcareous stones are ordinarily superposed upon the schistose rocks, as well as upon the primitive sandstone; they may be seen at 50 or 60 feet above sea level, and at this elevation contain a great quantity of detritus and debris of petrified shells."

Pliocene Drift.—In the small bight on the west side of Roll's Point, Kingscote, there may be seen resting against, and partially overlying the Miocene limestone, red loams and mottled clays, which have been shed from the metamorphic rocks constituting the elevated ground which terminates seaward at Kingscote Point. Similar beds are exposed on the western flank of the same ridge, along the east shore of the Bay of Shoals. But the most extensive section is that presented by the sea-cliffs, called "Red-banks" from the prevailing colour of the formation, which has a depth above sea level of about 100 feet. At this place we have evidently the remnant of an extensive plain constituted of the residuum of disintegrated rocks and of the diluvium brought down by surface drainage from the rocks forming the high lands to the east and south. Similarly the valley of the lower part of the Cygnet River is composed of loams, varying from clayey to sandy, as is shown in the deep banks confining the river and by the character of the soil. This formation is destined to play an important part in the *rôle* of the future agricultural history of the island, as it has done already in a slight measure. It affords the only soil of value, and I am sorry to have to say that its superficial area is comparatively small. On the map are indicated the chief Pliocene basins. One other claims special reference, it is that resting on the north flank of the Freestone Range, which owes its more argillaceous character to the disintegration of the diorite which forms the axis of that elevated track. The Pliocene Drift of Kangaroo Island is judged, by its mode of occurrence and by its lithological character, to be of pluvial origin—certainly not aerial as is the "loess" of some parts of this colony; and the absence of organic remains favours this assumption. Excepting in this last particular, it so much resembles the "drift" of the Adelaide Plain, and of others similarly constituted, that it may be relegated to the same period of time.

Pleistocene.—Much of the littoral tracts about Western

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Cove, Nepean Bay, are covered with recent marine deposits in the form of a succession of shell-banks, the most inland being about one mile from the present shore, and not less than about twenty feet above sea level. Around the head of the Bay of Shoals and about Pelican Lagoon the same phenomena are observable. The whole of the southern coast-line is encumbered with cliffs of calcareous sand-rock and recent sand-dunes, and in these respects is similar to other parts of South Australian shores washed by the Southern Ocean, as I have described with some detail in "Trans. Roy. Soc. S. Aust.," vol. II., pp. 67 and 113. The cliffs of calciferous sandrock attain to elevations of 100 to 150 feet or more, and are not infrequently crowned by blown sand. Mounts Mary and Bloomfield, Vivonne Bay, are of this character, and are respectively 272 and 224 feet high. By chemical metamorphism, the upper layers of the sandrock are more firmly consolidated, and by natural fracture—probably through failure of support—become broken up into rectangular masses, usually of large dimensions, which prove most serious obstacles to horse-travel. From Mount Prospect to Cape Willoughby, nearly the whole way is encumbered by this kind of material. Peron investigated closely the nature and origin of this calciferous sandstone, and fully recognised its relationship to the sand of the dunes. I will, therefore, reproduce his most pertinent remarks:—"The sand of the shore is very fine, of a quartzose nature, mixed with about one-fifth part of finely comminuted calcareous matter. It is driven from the sea margin by the winds upon a great part of the shore into dunes 60 to 80 feet high." "It is in the midst of this calcareous sandstone that trees are entombed, nay, even some entire portions of petrified forests. In many places, where the dunes are perpendicular, there may be distinguished perfectly the trunks of trees with their branches, and on the level surface they appear like broad mosaics. If these trunks are carefully examined, the several layers of ligneous tissue are discernible." Similar phenomena are stated by Peron to occur at Josephine Islands [Nuyt's Archipelago] and on the adjacent mainland, at Esperance Bay, at Leuwin &c., indeed "throughout a space of 25° of latitude and upon as wide extent of longitude the same appearances are reproduced on the south, west, and north-west of New Holland." Flinders describes the same phenomena as observed by him at Bald Hill, King George's Sound, but attributed them to coral reefs. And it has usually been considered that Darwin was the first to present a true explanation of their nature and origin. Nevertheless, in this he was anticipated by Peron, who 40 years earlier advanced the same explanations, though with less chemical exactitude. He says:—

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"So varied, so imposing as these phenomena are, yet they appear to me referrable to the same cause—a cause as simple as it is energetic. In effect, the numerous minute shells which multiply in these seas, and thrown up by millions upon the shore, are subject to the twofold influence of an ardent sun and a penetrating humidity. In losing a portion more or less of their carbonic acid, they tend to approach to the state of lime. This calcareous debris, pulverized by the action of the waves, becomes mixed with the sand on the shore, and forms with it a veritable calcareo-quartzose cement. This material encrusts the various substances which are found on the shore—shells, zoophytes, seaweeds, pebbles, all are agglutinated by it. Transported by the winds this active matter is deposited upon the neighbouring bushes—at first as a thin layer, later as a solidified mass embracing the stem; after this, the function of nutrition is impaired, the plant languishes, and while still living is in process of becoming petrified. On breaking the branches of these kinds of lithophytes there is to be seen, if the incrustation is recent, the ligneous tissue enveloped in a solid case but without any remarkable alteration; but as the calcareous envelope augments, the wood is disorganised, and is insensibly changed into a dry and blackish debris; then the interior of the tube preserves a diameter nearly equal to that of the branch which has served it for a mould; finally the tube becomes filled with quartzose and calcareous particles, and after the lapse of some years all is converted into a solid mass of sandstone. I have frequently referred to those enormous sand-dunes, which are raised like ramparts around the isles of New Holland, and at various points on the mainland. They exceed sometimes in height that of the tallest trees, and are composed of a sand like that of the shore, susceptible as it is of solidification, often the rock which supports them is of the same origin. On the inner slope of these moving hills, there grow various species of shrubs; in such a position, sand driven by the winds, or washed by the rain, accumulates at the foot of the trees and insensibly overwhelms them. Then after long periods of years have elapsed, the vegetable tissue in the trunk is altered, after the same manner we have seen it destroy the branch; the substance of the ligneous layers, being much more solid than that which occupies the intervals, is decomposed less rapidly than the latter; hence the concentric circles, which give to these extraordinary incrustations the appearance of true fossils, but on close observation it is easy to convince oneself, that these apparently petrified trees are nothing else than masses of more or less hard sandstone, which preserves only the vegetable form which had served it for a mould."

That elevation of the land has taken place during the exist

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ence of living marine forms is incontestable, and the evidences are in accord with those furnished by other localities on the south coast of this colony (see Trans. Roy. Soc., vol. II., p. lxviii.) Dudley Peninsula is at the present time joined to the main mass of the island by an isthmus, which at its narrowest is three-fourths of a mile wide. The connecting land is low; on the ocean side the pleistocene sand-rock forms a perpendicular cliff of about 40 feet high; from the summit of the cliff the surface of the ground slopes gradually inland till the shell-banks at a few hundred yards from the shore at the Head of American River are reached. These shell-banks have an elevation of from ten to fifteen feet above sea level. It has been alleged that the coast about American River is rising, but I am not satisfied on this point. From personal observation, I have no doubt that Pelican Lagoon is fast silting up, and it is highly probable that the appearances consequent thereon have given rise to the supposition that elevatory action has taken place within the last quarter of a century. The fact that Dudley Peninsula has recently been joined to the other part of Kangaroo Island may have some significance when we come to consider the origin of the flora and fauna of the island as it now is.

Superficial Accumulations and Soils.

On the main portion of the island, excepting the north coast, the exposures of the subter rock are rare, as it is concealed by superficial debris in the form of sand, or gravelly ironstone, or clays. The nature of the superficial detritus depends on the nature of the subjacent rock and on relative elevation. Sands largely prevail, and seem to have originated, as far as the limited exposures will allow of generalization, from quartzose-sandstones. Over the micaceous slaty beds ironstone gravels occur on the higher ground, sand on the lower slopes, whilst the basin-like depressions are levelled up with clay, more or less calcareous in proportion to the amount of contained shelly debris. In most instances the margin of the inundated ground is fringed by a sheet of calcareous travertine of several inches thick, derived from, and including debris of, the shells of living species of *Bulinus*. Not always is the mollusk living over the same area, inasmuch as through lapse of time the waters have acquired a too saline property for its existence. The large sheet of water called Murray's Lagoon is in this state; whilst its former extension and comparative freshness of its water are indicated by the considerable area above present water level covered by a white chalky clay teeming with the shells of a species of that freshwater water-snail.

All the above described surface deposits are of local origin, and are, either from their mechanical properties or from abso-

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lute sterility, unfit for agriculture. The very large area covered by these deposits has led hasty observers to condemn the whole island for agricultural purposes. Opinions on this head have been very conflicting. Flinders says:—"The soil of that part of Kanguroo Island [Kangaroo Head] examined by us was judged to be much superior to any before seen, either upon the south coast or upon the islands near it . . . . and I thought the soil superior to some of the land cultivated at Port Jackson, and to much of that in our stony counties in England." On the other hand, Peron characterised the island as monotonous and sterile. Sutherland's accounts were glowing; whilst the early settlers at Kingscote found the character of the soil did not hold out any very strong inducement for permanent or extensive settlement.

It is now easy to reconcile these apparently contradictory estimates of the character of the soil. The productive areas are limited and detached, and, as I have stated previously, are restricted to those of the Pliocene drifts. The sources of the material have been less local, than in the case of the more superficial deposits, and in consequence an intimate mixture of diverse mineral matters has resulted. The productiveness of this kind of soil is best attested by an appeal to agricultural statistics. The neighbourhood of Hog Bay has patches of land which carry as high as 50 bushels of barley to the acre; and at the Cygnet River and at Freestone Range the yield of wheat and barley last year ranged up to 30 bushels for the former and 50 to 60 for the latter per acre.

Useful Minerals.

The belief that Kangaroo Island is largely metalliferous and possesses coal is widespread, though up to the present time no discoveries have been made which justify such prophetic view. Nevertheless, the geological structure is not incompatible with the existence of metalliferous deposits, though it precludes the presence of workable coal.

Gold.—The earliest discovery of this metal is that recorded by Mr. Tolmer in his recent work entitled "Reminiscences," 1882. He therein states at p. 320 of vol. I. that he found in a freshwater creek near Vivonne Bay "a quartz specimen, with a small portion of yellow metal embedded therein, which I have now no doubt was gold." Mr. T. Willson has obtained gold from a quartz reef situate in the northern part of the Hundred of Haines, and further informs me that it has been gathered from detritus at Pig's Head Flat, Dudley Peninsula.

Tin.—Mr. Tolmer writes further that he revisited the spot in 1856, and obtained by washing the stuff of the bed of the creek about one ounce of black sand, a sample of which was

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tested by Mr. G. W. Goyder, Surveyor-General, and pronounced by him to be tin.

Copper.—Ores of this metal most certainly occur, and several applications for mineral claims had been granted between the years 1861 to 1865, but in all cases the leases were forfeited. The sites of these claims were at Hog Bay, Cape St. Albans, Cuttlefish Bay, three miles south-west of Kingscote, twelve miles west by south of the mouth of the Cygnet River, and seven miles westerly from Mount MacDonnell.

Lead.—I have been shown specimens of *galena*, stated to have come from a large vein situated to the west of Smith's Bay, on the north coast.

Petroleum.—From a very early period in the history of the occupation of Kangaroo Island there had been known and used a pitch, which was collected upon the south coast; but it is only through the above-mentioned work of Mr. Tolmer that any of the observed facts have been committed to writing. He says:—"During my wanderings along the south coast I observed numerous fragments of a substance resembling pitch, which was stated to be plentiful, and to be used in lieu of the imported pitch in paying the seams of the vessels and boats built and repaired on the island. Some twenty years after, in 1864, I revisited the island, and was conducted to the spot where the petroleum exudes from the fissures in the rocks" (loc. cit. I., p. 320).

In 1871 coal leases were granted by the Crown Lands Department of 10,000 acres each at False Cape and Flour-cask Bay; and at an earlier period borings were made in the cliff at a point about three miles west from the mouth of the Hog Bay River and at Vivonue Bay—in all these cases with the ostensible object of working the petroleum deposits, which were alleged to exist on this part of the coast, an inference drawn from the presence of pitch fragments on the beach. I have conversed with several islanders as to the place and mode of occurrence of the substance, and have moreover inspected the site of one of the above-referred-to bore-holes, and the shore line of Flour-cask Bay. The substance has been picked up at many points along the south coast, chiefly on the western beaches of the bays, and Vivonne Bay in particular was an important repository for it. The opinion as to the exudation of the substance from the rocks on the shore line is most assuredly based on erroneous observation, inasmuch as when thrown up beyond high tide and subjected to a hot sun it would be softened and insinuate itself among the crannies and irregularities of the surface of the calciferous sand-rock, and would present to the untrained

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observer the appearance of having flowed from the rock. Moreover, the nature and origin of the surface rock preclude the probability of its having been contained in it. So also do those of the subjacent mica-schist, into which the boring was made at the spot previously indicated. Indeed, all the circumstances conspire to prove, that the substance is a waif upon these shores. Corroborative evidence is afforded by the finding of the same substance at Coffin Bay, Eyre Peninsula, *resin* at Fowler Bay, *beeswax* at the head of the Great Australian Bight and *gutta-percha* at Eucla. Doubtlessly all have formed part of the cargo of some wrecked vessel. Mr. G. Dixon informs me that he found in 1867 a mineral pitch in the whole littoral tract between Cape Arid and Doubtful Island Bay, West Australia. Moreover, the substance, locally known as *dammar*, belongs to at least three different chemical bodies. The commonest kind is black, breaking with a lustrous conchoidal fracture; melts easily and burns with a bright flame, evolving an asphaltic odour. On distillation it yields dark-coloured hydrocarbon oils and parafin, leaving a copious residue of carbon, without ash; it is insoluble in nitric acid, alcohol and turpentine, but is partly soluble in benzole. It resembles in appearance and properties a refined asphalt, but is more lustrous than that obtained at Trinidad with which it has been critically compared.

Another material similar in most respects, softens under the fingers and is soluble in oil of turpentine and nitric acid. A third matter, picked up between Hog Bay and Table Cape, is resinous-brown with dark stripes and externally yellow, brittle; burning with a bright flame and giving off an aromatic odour; on distillation it yields a little parafin and oils, without residue. It is insoluble in alcohol and nitric acid, but readily soluble in bisulphide of carbon.

Coal.—In 1879 a reported discovery of good coal at Hog Bay raised the hopes of the Adelaide public, that the opinion touching the absence of coal within this colony was not to be prophetic. I visited the locality, and certainly found fragments of a steam coal in the soil of a barley-field; but the presence of mica slate around the basin of drift deposit was sufficient to satisfy the geologist, that the coal was not derived from the immediate neighbourhood. Finally I traced it to a discarded smithy, the rubbish of which had got mingled with the manure heap, and so carted to the field and worked into the soil. Mr. Tolmer's "firm belief that coal will eventually be found by boring in the flats and about Hog Bay River" (loc. cit. I., p. 321) must fail to find endorsement at the hands of the veriest tyro in geology.

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Climatology.

Kangaroo Island has been spoken of as the sanatorium for South Australia in the future; and it well deserves this prospective reputation. The climate is characterised by a warm temperature, without that heat fervency in summer which is so familiar to residents on the mainland, by moist winds, a good rainfall and the absence of frosts.

Some meteorological observations were made by Peron during his stay at Nepean Bay extending from January 6 to February 1, 1803, which I will quote:—"The mean of our thermometric readings at noon were 65·6° Fahr. The 20th, 25th, 27th, 29th and 30th January were the hottest days; the mercury in the shade at 2 p.m. showed on the island 81·5° Fahr.; the land breezes—that is to say, those from the N.E., N.N.E., and E.N.E.—dominated then, and we were satisfied that they partook of the nature of the hot winds, which desolate the interior of Australia. The atmosphere over the arid and low shores exhibits nearly always a perfect serenity. In the space of one month we had only a few slight showers; on January 15 a feeble storm which arrived from the west was dissipated as soon as, so to say, it had touched the shores of the island. The range of the hygrometer was conformable with the state of the atmosphere, and was comprised between 68° and 94°, the mean term being 82·05°. But of all the results which were obtained of this kind the most noteworthy was the rapid movement of the needle towards dryness at the moment when the N.E. winds blew with force after midday of the 29th —from 94° it retrograded to 68°." The figures given by Peron should not be examined rigidly; but they suffice to show the relatively low temperature and the absolutely great humidity of the air during the second hottest month in the year. They are not altogether in accord with the results of similar observations made at Cape Borda under the direction of Mr. Todd, and published by him in "Meteorological Observations for 1880," from which I have taken the following results. Cape Borda is the most north-west point of land, and the station is at an elevation of 506 feet above sea level:—

Humidity.—The yearly mean—	Cape Borda.	Adelaide.
	72	57
The extremes—	61 for February	37 for January
	82 for September	78 for June.

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Temperature.—	Cape Borda.	Adelaide.
	°	°
The yearly mean... ...	... 58·1	62·4
Maximum, January 31 ..	... 93·0	114·5
Minimum, September 26	... 40·0	35·0
Mean diurnal range for the year,	8·2	18·9
Greatest diurnal range ...	... —	48·0

Rainfall.—At Cape Borda, average for 12 years, 23·8 inches.
American River " 15 " 20·33 "
Kingscote, for year 1880 ... 19·65 "

The rainfall on the north coast of Kangaroo Island is about equal to that at Adelaide, but the other climatic elements, as indicated in the foregoing tables, show in what way the climate of Kangaroo Island is superior to that of Adelaide. The south coast during the summer months is visited by light and local showers, which do not penetrate far inland, but which doubtlessly serve to maintain a perennial flow of water in the many channels of the south-western portion of the island.

Botanical Explorations.

1. Robert Brown, the naturalist to Flinders's expedition, carried the first botanical collection from Kangaroo Island to Europe. The number of species was small, but it included types of several new species. In the "Flora Australiensis," the locality-name, *Kangaroo Island*, with the collector's name, *R. Brown*, annexed, will be found recorded under 29 species names. Robert Brown's opportunities for extended botanical work were few, and the period of his visit was unfavourable. From the narrative of the voyage I compile the following brief diary:—March 22 and 23, 1802, on shore at Kangaroo Head. April 2-5, 1802, on shore at Kangaroo Head; boat excursion to American River and Pelican Lagoon; ascended Prospect Hill, situated on the isthmus connecting Dudley Peninsula with the main mass of the island. The collection was derived almost entirely from the littoral tracts, and Robert Brown could not have seen the characteristic inland flora.

2. Latour Leschenault, one of the botanists to Baudin's expedition, who followed in the next year, sojourned off Kingscote from January 7 to February 1, 1803; and he tells us, that "the island is sandy and without rivulets, that the vegetation is beautiful, and the plants very varied. I have discovered a great number of new species" ("Peron's Voyages," vol. II., p. 366). F. Peron, the zoologist to the expedition, and the author of the narrative, writes:—"At the head of this grand bay [Nepean Bay] there are forests which appear to extend far away towards the interior, and which are composed of different

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species of *Eucalyptus*, *Banksia*, *Phebalium*, *Acacia*, *Casuarina*, *Metrosideros*, *Leptospermum*, *Styphelia*, *Conchium*, *Diosma*, *Hakea*, *Embothrium*" &c., &c. (op. cit., vol. I., p. 76). From the narrative of the expedition it is uncertain, if other opportunities were offered for collecting plants than during the long stay in Nepean Bay, unless it were at Hog Bay. Leschenault botanised at other parts of the Australian coasts, but the collection as a whole remains unpublished up to the present day. Desfontaines made a few selections from the West Australian plants gathered on this expedition, but with few exceptions not any of the Kangaroo Island plants were described, though doubtless all have been identified. Mr. Bentham examined many of the plants of Baudin's expedition in the Paris herbarium for the "Flora Australiensis," but from that collection only two species are recorded for Kangaroo Island:—*Eucalyptus incrassata*, erroneously attributed to Labillardiere, who was never on the island, and *Acacia dodonæifolia*. Leschenault (loc. cit., vol. II., p. 366) cites a few species, which he had observed on Kangaroo Island. A species of *Nicotiana*, which grows on the sands by the sea shore" [is certainly *N. suaveolens*]. "A *Melaleuca*, with long filiform leaves" [is doubtlessly *M. uncinata*], and "another with yellow flowers" [is probably *M. squarrosa*]. "Many new species of *Eucalyptus*." "A very pretty species of *Anthericum*" [perhaps *Arthropodium laxum* or *Bulbine semibarbata*]. "A plant of the order Irideæ" [this is in all probability *Sisyrinchium cyaneum*, which grows abundantly about Kingscote]. "A new species of *Solanum*" [*S. simile* is the only species excepting the European *S. nigrum* known to occur]. "A very pretty and very singular *Convolvulus* without stem;" on Leschenault's specimens Choisy founded his *C. acaulis*, which, according to Baron Mueller, is clearly the minute state of *C. erubescens*. To the above there should be added *Eucalyptus diversifolia*, described by Bonpland in 1813 from specimens grown from seeds gathered at Kangaroo Island during Baudin's expedition. The specific name, as only applicable to the young state of the plant, has been discarded for that of *santalifolia* (see F. v. Mueller's "Eucalyptographia, Decade 8").

3. For nearly half a century from the date of the visit of the second of the two memorable expeditions, Kangaroo Island was unvisited by any collector or scientific observer. Between the years 1849-51, Messrs. E. G. Sealey, Bannier and Henry Heuzenroeder went at different times to Kangaroo Island, and it was on the special solicitations of Baron Sir (then Dr.) F. von Mueller, that they brought back plants. Forty-four species, previously unrecorded, were brought to notice by them, though in the Flora Australiensis the credit is inadvertently

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given to Baron Mueller, who had never visited the island, but by whom the species were transmitted to Mr. Bentham.

4. Mr. F. G. Waterhouse was sent in 1861 by the South Australian Government to search for insects and other zoological objects, and as a result of byework about a hundred species of plants were collected, which passed into the hands of Baron F. von Mueller, by whom the novelties were specially dealt with in vol. iv. of his "Fragmenta Phytographiæ." Five species new to science were the chief results of Mr. Waterhouse's labours, and eighty-three species-names added to the list of the local flora. Mr. Waterhouse had his head-quarters on the Cygnet River, at a few miles from Kingscote, and spent there the spring and summer months. His collection of plants was gathered chiefly from the wooded banks of the river and the heath-ground adjacent thereto.

The floral statistics at the period of the completion of the "Flora Australiensis" are as follows:—

Number of species brought to notice by

1.	Robert Brown	29
2.	Baudin Expedition	4
3.	Messrs. Sealey, Bannier, and Heuzenroeder ...	44
4.	Mr. F. G. Waterhouse	83
		160

5. This small number of species recorded for so large an insular mass as Kangaroo Island remained stationary until 1881, when largely influenced by the representations of Baron Mueller, I visited the island towards the close of December in that year, having for a companion Mr. S. Dixon. [I had already in 1879 visited Hog Bay, but at an unfavourable time of the year for botanical work.] My explorations extended from Kingscote to the Cygnet River, along the south shore of Western Cove, to Mr. Buick's house on the American River; thence a journey was made across sandy heath-country to D'Estrèes Bay; from the American River travelled along west shore of Pelican Lagoon and Prospect Hill, and by the coast to beyond the mouth of Hog Bay River, inland to near the source of that river, the return journey following the outward track. The number of unrecorded species collected was 111; of these the following six were at that time unknown to inhabit any part of South Australia:—*Cakile maritima*, *Wilsonia Backhousii*, *Styphelia striata*, *Ottelia ovalifolia*, *Caustis pentandra* and *Dichelachne sciurea*.

6. Having failed to secure local help, especially in reference to the collecting of vernal plants, I urged my young friend and late pupil, Mr. R. S. Rogers, B.A., to undertake the task;

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and he accordingly spent from June 24 to July 13, 1882, on the island, dividing his stay between Kingscote and Hog Bay. He added four unrecorded species, one of which (*Pterostylis præcox*) was new to South Australia.

7. During the latter part of January, 1883, a more extensive exploration was undertaken by me than before attempted—this time in company with Mr. J. E. Brown, F.L.S., Conservator of Forests. Starting from Kingscote, we journeyed by way of Bay of Shoals to Freestone Hill, thence crossed the Cygnet River near its mouth, proceeding thence to White Lagoon, from the latter place following the track via Hawk's Nest, Murray's Lagoon, Mount Pleasant, to Mount Mary, Vivonne Bay; thence to the Harriet River, and as far as Karatta, on the Stun'sail-boom River. The return journey was varied by following the shorter track from Mount Pleasant to the Cygnet River, striking however that river at four or five miles above the previous crossing place.

The number of additional species collected was 75, bringing up the total of species now known to inhabit the island to 350. Of these *Achnophora Tatei* is the type of a new genus, and the following are additions to the Flora of South Australia:—*Phyllanthus australis*, *Hydrocotyle tripartita* and *Lobelia platycalyx*.

The total number of species now known to inhabit Kangaroo Island is absolutely small, and by reference to the appended list of species it may be noticed, that the number of annual plants is relatively meagre; and though I doubt, if Kangaroo Island be rich in such, yet it is not improbable, that the grassy slopes of the Freestone Range and the bare hills on the Dudley Peninsula will be found to yield some unrecorded annuals and other vernal plants. Its botany is not yet exhausted, and in addition to a re-examination of the districts already traversed at different periods of the year, there still awaits the explorer the comparatively vast region of upland country forming the basin of the upper Cygnet River.

Though extremely anxious, to pursue these investigations until some measure of completeness is attained, yet I hesitate to face difficulties, which in all likelihood would be greater than those experienced on past occasions. Under these circumstances I have thought it best to submit the information, I have brought together, touching the botanical productions of this island.

8. [Supplemental Note.]—During the month of October, Mr. T. Willson, of Hog Bay, was so kind as to forward me two parcels of fresh plants, hurriedly collected in his immediate neighbourhood; among these were some ephemerous species hitherto unrecorded. Encouraged by this success, I revisited

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Dudley Peninsula, devoting eight days in the middle of November to a thorough search over its western half, with the result of adding 65 species to the insular flora and *Stipa teretifolia* and *Schœnus sculptus* to the provincial flora, and *Hydrocotyle crassiuscula*, new to science. The total number now known is 415.

Artificial Influences Modifying Vegetation.

In the interests of phytogeography it is imperative, that we should without loss of time ascertain the precise nature of the flora of the island undisturbed by artificial modifications. In the lists of Robert Brown and Leschenault we have an enumeration of the feral productions, but as all subsequent botanical collectors have for the most part worked within an area exposed to man's disturbing agencies, it becomes difficult to eliminate from their gatherings those species, which may be suspected to be aliens; for in this connection we have not only to deal with exotics, but with immigrants of South Australian origin. In respect to the latter, the study of their geographical distribution will not always help to discern between the truly indigenous and the artificially introduced. The question is an embarrassing one to the botanist, and should be kept well in view, when recording the habitats and stations for all plants. A few species indigenous to Australia may be suspected from their environment to be of modern introduction in Kangaroo Island.

That changes in the floral aspect are being brought about by man is only too obvious, and though it is not always easy to track these migratory plants to their original cradle; yet certain parts of the island will continue for a little time to come to be free from the disturbing agencies, to which I will now refer.

The disturbing agencies are:—

1. *Farming and Gardening Operations.*—In my brief sketch of the history of settlement and occupation on the island I have indicated the localities and given the dates of settlement, as far as the data at my command admitted. These facts may be of future use, when the more obvious traces of man's early occupation have disappeared from the sites of some of these older settlements, and will explain the origin of some doubtfully indigenous plant. At Duck Lagoon, on the Lower Cygnet River, I gathered specimens of a *Linaria*—evidently a garden escape, though all traces of garden and homestead had disappeared; yet on inquiry I learnt, that many years ago a hut and enclosure existed on the very spot.

2. *Depasturing of Sheep.*—Sheep in small flocks have been scattered over much of the island for many years; but it is only within the last two years, that any importation in large num-

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bers has been attempted by the Messrs. Taylor Brothers, who have brought sheep from the South-East to stock their run in the south-west portion of the island. Sheep are important agents of transport of such plants, whose seeds are readily entangled in their wool; and it will not be unexpected, if some of the south-eastern plants should make their appearance. From the stations, at which I found *Acæna sanguisorbæ*, I have concluded, that the dispersion of the plant has been effected by sheep, as in almost all instances it occurs about sheep stations or watering places. However, the species is truly endemic, as Robert Brown collected it in 1802, though I believe it has been introduced into many of the localities, at which I met with it. The constant cropping of the more edible shrubs and herbs—and of these there are few—by sheep must materially disturb the balance of plant life, tending towards the extinction of the preferred species and the increase of the rejected.

3. *Periodic Burnings of the Scrub.*—So scanty is the feed in the scrub lands, that it has become the practice of the sheep-farmers to burn off the bushy growth and depasture the sheep on the herbaceous plants and the tender shoots of the arboreous species, with which the burnt ground soon becomes scantily clothed. Though grass covers much of the coast hills, yet it is abandoned by the sheep in favour of the herbage of the burnt lands; moreover, sheep are subject to a wasting and fatal disease, known as "coast sickness," if pastured continuously on these littoral tracts. The burning of the scrub calls into being some few species that are rarely or ever seen under other conditions; such are *Cassinia spectabilis*, *Ptilotus Beckeri*, *Senecio odoratus*, *Plagianthus spicatus*, *Poranthera ericoides*, &c. In the case of the Cassinia, which appears to be biennial, it forms dense brakes, often reaching to four or five feet in height, and covering some square miles, as I have seen it on the south-east coast. *Senecio odoratus* monopolises for a time other areas of burnt ground. The other species mentioned occur somewhat sparsely. The firing of the scrub is repeated over the same areas every fourth or fifth year, for it takes about that time, to replace the bushes in a state of thickness sufficient to feed a fire again. The only plant, which escapes destruction is the grass-tree. The vegetation is reinstated by the germination of the seeds, which have been dormant in the soil, and remained untouched by the fire, and by the development of new branches from the root-stocks of some of the larger-growing shrubs. The practice must inevitably bring about the extinction of those species, which do not mature their seeds before their fourth or fifth year; also many of the annuals, whose seeds are not well protected to pass unscathed through the fiery ordeal, will be exterminated over the area of

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the conflagration. The passage of a light fire is, however, favourable to the dispersion and germination of the seeds of Acacia, Hakea, Grevillea, Banksia &c. The scrub is burnt usually in March, at a time when the vegetation is dry and has disseminated its seeds. If this periodic denudation of the scrub by fire be persisted in, disastrous results must indubitably follow; the scrub shields the loose sandy soil from the action of the wind and rain; remove this, and these agents will in time bring about a transformation in the aspect of the vegetation—the sand will be swept from the tops and slopes of the rises, laying bare the subjacent rock, and will be drifted on to the clayey flats, thus converting the whole into stony wastes surrounded by sandy deserts. In an arid country an appreciable change would at once be discernible, but as Kangaroo Island is favoured with a humid atmosphere, the chief disturbing agent is not so active. Concurrent with the change in its surface conditions there will be one in its vegetation.

General Botanical Features.

Kangaroo Island in its botany presents almost a unity, as it is only over very limited areas, that there is any marked departure from one type of vegetation. The subordinate features are more or less referable to the nature of the subjacent rock. The prominent groups of vegetation are—

1. *That of the Heathy Scrub-Lands.*—In my geological sketch I have stated, that the major part of the island is covered by sand and fine ironstone-gravel, derived from the waste of metamorphic rocks in place. It is upon these soils that the most characteristic and varied of the vegetation of Kangaroo Island exists. The vegetation is comprised of a dense thicket of shrubs and shrubby states of trees, and opposes an almost effectual barrier to both man and horse. This scrub varies in stature and somewhat in nature, according as the soil is a dry or moist sand, or gravel, or a loam. Interspersed are clay-flats which are fed by surface flow of water from the surrounding higher ground; they are soft and boggy in winter, but are level and dry, almost indurated, in summer. The soil is for the most part devoid of water, but in a few instances, where clay underlies a thin covering of sand, as towards D'Estrees Bay and near Karatta, the heathy ground yields water by digging for the whole year. Leschenault* attributes "the vigour of the vegetation, which is not impaired by the sterility of the soil, to the impervious nature of the rocks which underlie the sands, and by which the infiltrated pluvial waters are arrested and retained." In general, the

* Peron's "Voyage aux Terres Australes," vol. ii., p. 366.

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scrub is constituted of *Casuarina distyla*, *Banksia marginata*, *Hakea flexilis*, *Melaleuca gibbosa*, *M. uncinata*, *Eucalyptus capitellata*, *E. gracilis*, *E. cosmophylla*, *E. incrassata*, *Xanthorrhœa quadrangulata*, *Acacia armata*. The constituents of the more heathy portions are *Leptospermum scoparium*, *Adenathos*, spp., *Choretrum glomeratum*, *Prostanthera*, spp., *Dodonæa Baueri*, *Bertya rotundifolia*, *Calycothrix*, *Eremophila Brownii*, *Lhotzkya glaberrima*, *Styphelias*, *Petrophila multisecta*, *Ixodia achilleoides*, *Hakea rugosa*, *H. rostrata*, *Logania ovata*, *Spyridiums*, *Boronia filifolia;* the larger shrubs infested with *Cassytha melantha*, and the smaller with *C. pubescens* and *C. glabella*. Whilst the chief herbaceous plants are *Lepidosperma filiforme*, *Lobelia microsperma*, *Thysanotus dichotomus*, *Candollea graminifolia*, *Schœnus Tepperi*, *Goodenia geniculata*, *Trachymene heterophylla*, *Xanthosia dissecta*, *Loudonia Behrii*. The interspersed clay flats are chiefly occupied by *Lepidosperma viscidum*, *Juncus pallidus* and *Chorisandra enodis*, margined with thickets of *Callistemon coccineus* and *Melaleuca gibbosa*. In a few instances trees of either *Eucalyptus corynocalyx*, *E. rostratus*, *E. leucoxylon*, or *E. cosmophylla* form an open forest, beneath which the herbage is more varied. Where the soil is saline, *Melaleuca pustulata* forms a dense woodland growth, though of low stature.

2. The *Sylvan Vegetation* is confined to the borders of the watercourses, and the chief forest tree is *Eucalyptus corynocalyx*, with which is associated not infrequently *E. leucoxylon*, and occasionally *E. rostrata* and *E. viminalis*. The banks of the streams are quite concealed by an impenetrable growth of *Acacia retinodes*, *Leptospermum lanigerum* and *L. myrsinoides*. In the shade of these jungle-like growths luxuriate many species of herbaceous plants, whilst the forest-glades are rich in many shrubby plants, which do not occur on the scrub-lands. Such are *Grevillea parviflora*, *Pomaderris racemosa*, *Bursaria spinosa*, *Acacia rupicola*, *A. verticillata*, *Exocarpos cupressiformis*. Here the grass-trees attain unusual stature, the trunk reaching to a maximum height of fourteen feet, and the spike to sixteen feet; and in association with loftier plants they lose the weird-like appearance, which they present on the open lands, and impart quite a tropical aspect to the floral scenery.

3. *The Savanna Vegetation.*—On the north coast of Dudley Peninsula the hill-slopes are more or less grassed, and have scattered over them groups of *Casuarina quadrivalvis*. The same appearance is seen at Kingscote. In both areas the metamorphic rocks are almost denuded of soil. But on the north slope of the Freestone Range, as about Emu Creek, a fine park-like country occurs, dotted here and there with clumps of *Eucalyptus cneorifolia*, the habit and foliage of which have

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none of the sombreness and quaintness, which characterise many of its congeners; intermingled are *E. incrassata* and *E. santalifolia*. This kind of vegetation merges on the one hand into that of the heathy ground at lower elevations, and into that of the sugar-gum tree, forests of which crown the crest of the range and occupy its ravines.

4. *The Vegetation of the Littoral Tracts.*—The mud flats around the shores of Nepean Bay, Bay of Shoals and Pelican Lagoon have the customary assemblage of plants affecting such situations—*Lepigonum marinum, Salicornias, Suæda, Mesembrianthemum australe, Atriplex paludosum, Polycnemon, Samolus, Melaleuca pustulata.* Passing into the subsaline plains coterminous with these, we meet with an herbage of *Sporobolus virginicus*, amongst which the above-mentioned plants also grow; and in addition may be noted *Agrostis Solandri, Poa cæspitosa, Juncus pallidus, Centipeda Cunninghami, Bulbine semibarbata, Myoporum insulare, Rhagodia crassifolia* and *Sisyrnichium*. The banks of shell sand and blown sand yield a number of the species of the scrub-lands; but as almost confined to these situations may be mentioned *Callitris verrucosa, Dodonæa viscosa, Myoporum viscosum, Mesembrianthemum æquilaterale, Clematis microphylla, Scirpus nodosus, Spinifex hirsutus, Atriplex cinereum.* On the rocky shores and adjacent slopes there occur *Rhagodia crassifolia, Nitraria Schoeberi, Geijera parvifolia, Alyxia buxifolia, Pittosporum phillyræoides, Enchylæna tomentosa, Muehlenbeckia adpressa.* The hills of blown sand and calciferous sandstone, which dominate the whole of the coastline on the south side of the island, yield a variety of plants. On the inner slopes of the sand dunes are dense thickets composed of *Eucalyptus incrassata, E. santalifolia, Melaleuca parvifolia, Acacia retinodes* and *A. armata*; here occur *Veronica distans, Helichrysum leucopsidium, Ixolæna supina, Mesembrianthemum æquilaterale, Lotus australis, Dodonæa humilis, Kunzea pomifera, Lepidosperma gladiatum, Goodenia varia, Scævola crassifolia, Styphelia Richei, S. ovalifolia, Scirpus nodosus.*

The Vegetation of Dudley Peninsula is largely of the sylvan and savanna types; over the area occupied by mica-slate, are natural pasture-lands interspersed with she-oak, *Melaleuca parviflora* and the narrow-leaf mallee, merging into mallee scrub, chiefly constituted of *Eucalyptus cneorifolia* and *E. incrassata*, but not dense enough to obstruct the passage of man or horse. On the northern water-shed, the slopes are seamed with short and steep gullies; but on the opposite side, the stream courses are long and bordered by wide flats of drift deposits. The flats are covered with natural grasses, chiefly *Stipa aristiglumis, Poa cæspitosa, Festuca bromoides, Danthonia penicillata* and *Agrostis*

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Solandri, and dotted here and there with groups of blue-gum trees.

The central part of the Peninsula—about the sources of Hog Bay River and the tributaries of Deep Creek, is an elevated table-land composed of loose sand or ironstone-gravel resting on a clay; here the vegetation is like that of the heathy scrublands so characteristic of the main mass of the island, though it seems to be much less rich in species.

Indeed, there appears to be very considerable specific disparity between the florula of Dudley Peninsula and that of the other and larger part of the island, but it is premature to deal with the nature and probable causes of the differences. However, in the list of species belonging to the island, I have given such localities as will be of future use in working out the distribution of the species within insular limits.

Correlation of the Flora.

Restricted species.

The total number of flowering plants and vascular cryptogams catalogued in the accompanying list is 415; of which 404 species are continental, leaving about 11 as restricted to the island.

In the Flora Australiensis, Kangaroo Island is credited with the possession of twelve species not known elsewhere; however, extended research has reduced that number to eight, and has added three, making a total of eleven. They are as follows:—

1. *Cheiranthera volubilis**, Bentham.
2. *Bertya rotundifolia*, F. v. M.
3. *Lhotzkya glaberrima*, F. v. M.
4. *Melaleuca cylindrica*, R. Brown.
5. *Cryptandra Waterhousei*, F. v. M.
6. *Cryptandra halmaturina*, F. v. M.
7. *Petrophila multisecta*, F. v. M.
8. *Helichrysum adenophorum*, F. v. M.
9. *Achnophora Tatei*, F. v. M. (monotypic genus).
10. *Pultenæa viscidula*, Tate (inedit).
11. *Hydrocotyle crassiuscula*, Tate (inedit).

The following species, which were established on Kangaroo Island plants, have since been found in extra-limital parts:—

1. *Chenopodium pumilio*, R. Brown, is now merged in *C. carinatum*, R. Brown, and as such is widely distributed throughout Australia, and reaching to New Caledonia and New Zealand.

2. *Atriplex prostratum*, R. Brown, now includes *A. microcarpum*, F. v. M., and *A. pumilio*, R. Brown, and as an aggregate

* Baron von Mueller includes this under *C. linearis*.

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species is known from other parts of South Australia and from New South Wales.

3. *Thryptomene ericæa*, F. v. M., is, according to the author of the "Systematic Census of the Plants of Australia," an inhabitant of Victoria.

4. *Darwinia micropetala*, F. v. M., in a varietal form inhabits Central Australia and also in the vicinity of Guichen Bay.

5. *Eucalyptus Baxteri*, which was established on Kangaroo Island samples obtained by Robert Brown, is antedated by *E. santalifolia*, F. v. M. *Eucalyptus diversifolia*, Bonpland, was founded on specimens obtained during Baudin's expedition, The name has been abandoned in favour of *santalifolia*. The species is known from the neighbouring parts of the mainland and from West Australia.

6. *Acacia dodonæifolia*, Wildenow. One other station for it is Port Lincoln.

7. *Convolvulus acaulis*, Choisy, which was described from Leschenault's specimens gathered on Kangaroo Island, represents merely an individual variation of the widely-spread *Convolvulus erubescens*.

Several apparently well-marked varieties have been described and considered restricted to the island. With one exception these varieties arise from the effects of wind and moist sea air, as I have proved by tracking them from their maritime stations inland until the normal form is acquired. The marked exception is *var. acuaria* of *Grevillea parviflora*, a species of the Victorian Alps. I think that the Kangaroo Island plant has fair claim to specific rank under the cognomen *G. halmaturina*. It has recently been gathered in the Port Lincoln district by Mr. S. Dixon!

Additional species not known in any other part of South Australia, though extra-limital, as indicated by the affixed initial letters in the subjoined geographic columns, are as follows:—

Cakile maritima ...	...	T.	V.	N.S.W.	...
Phyllanthus australis.	...	T.	...	...	...
Thryptomene ericæa ..	...	...	V.	...	...
Hydrocotyle tripartita	...	T.	V.	N.S.W.	Q.
Adenanthos sericeus ..	W.A.	...	...	...	...
Lobelia platycalyx ...	...	T.	V.	...	...
Scutellaria humilis ...	...	T.	V.	N.S.W.	Q.
Styphelia striata ...	W.A.	...	...	...	...
Pterostylis præcox ...	...	T.	V.	N.S.W.	Q.
Schœnus sculptus ...	W.A.	...	...	...	...
Stipa teretifolia ...	W.A.	T.	V.	...	...
Dichelachne sciurea ...	...	T.	V.	N.S.W.	Q.

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Phytogeographic research in Kangaroo Island brought first to notice the following additions to South Australian flora, though they have subsequently been found in other parts of the colony:—*Pomaderris apetala, Cassinia spectabilis, Wilsonia Backhousii, Caustis pentandra.*

Species of Extra-Australian Origin.

It is noteworthy that the number of more or less cosmopolitan species is not great; thus, whilst the number of such in South Australia approaches 100, there are not more than 55 on Kangaroo Island. With the exception of three, they all occur on the larger insular mass of Tasmania, which possesses at the least 90 extra-Australian species. The paucity of cosmopolitan species on Kangaroo Island cannot well be explained except on the assumption of isolation before immigration, else Tasmania, so rich in peculiar genera and species, should possess even a fewer number; whereas it contains nearly twice the number. An analysis of the habitats of the several species indicates, that two-thirds of the Kangaroo plants of this category are either maritime or paludinal. There are a few weeds, and their occurrence as indigenous may be disputed. The wide dissemination throughout Australia of plants of this kind may, I think, be attributed to the agency of aboriginals, at least as far as regards those species, the nativity of which is not questioned. Kangaroo Island had never been subject to such disturbing influences until the last 50 years, hence its freedom from aggressive plants. Of the native species occurring beyond Australia also, the following are:—

Maritime.

Lepidium ruderale
Cakile maritima
Capsella procumbens
Nitraria Schœberi
Frankenia lævis
Spergularia marina
Suæda maritima
Mesembrianthemum australe
æquilaterale
Apium prostratum
Halophila ovata
Ruppia maritima
Lepturus incurvatus
Sporobolus virginicus
Distichlis maritima

The following widely distributed shore-species seem absent:—*Salsola kali, Avicennia officinalis, Juncus maritimus* and *Scirpus maritimus.*

Paludinal.

Epilobium tetragonum
Hydrocotyle Asiatica
Cotula coronopifolia
Cotula filifolia
Potamogeton natans
obtusifolius
pectinatus
Juncus bufonius

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Centipeda Cunninghami
Lobelia anceps
Selliera radicans
Gratiola Peruviana
Limosella aquatica
Triglochin striata
Heleocharis multicaulis
Scirpus cartilagineus
riparius
fluitans
Schœnus nitens
Carex pseudo-cyperus
Lomaria capensis

Sylvan.

Ranunculus parviflorus
Hypericum Japonicum
Parietaria debilis
Gnaphalium Japonicum
Wahlenbergia gracilis
Oxalis corniculata
Geranium Carolinianum
Stellaria glauca
Daucus brachiatus
Luzula campestris
Dichondra repens
Festuca bromoides
Pteris aquilina
Adiantum Ethiopicum

Weeds.

Lepidium ruderale
Papaver aculeatum
Sagina apetala
Spergularia rubra
Gnaphalium luteo-album
Solanum nigrum
Lepturus incurvatus

Alien Species.

As to the endemic origin of the forementioned extra-Australian species, there cannot be any uncertainty, except as regards some of those which I have grouped together as weeds. *Gnaphalium luteo-album* is apparently restricted to the vicinity of homesteads, and *Lepturus incurvatus* occurs under suspicious circumstances on cultivated clay-lands at Kingscote, but is certainly native around the shores of "Salt Lagoon," at the head of the Bay of Shoals. *Lepidium ruderale* is another species, apparently native at one or two places, which has become domesticated. I have not paid particular attention to the occurrence of alien species on the main mass of the island, but the following occur:—

Chenopodium glaucum, Kangaroo Island [probably Cygnet River], *Waterhouse.*

Onopordium acanthium. Known since the last two or three years about The Gap.

Picris hieracioides, Kangaroo Island, *Waterhouse.* Discovery Flat!

Sonchus oleraceus.

Lagurus ovatus. Roll's Point, Telegraph Reserve; and by homestead, Eleanor River. Doubtlessly planted.

On Dudley Peninsula, the following agral-weeds are nearly all of common occurrence:—

Seniebiera didyma, Capsella bursa-pastoris, Sisymbrium

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officinale, Malva rotundifolia, Erodium cicutarium, Urtica urens, Silene Gallica, Stellaria media, Cerastium vulgatum, Chenopodium glaucum, Polygonum aviculare, Vicia sativa, Medicago denticulata, Melilotus parviflorus, Alchemilla arvensis, Centaurea melitensis, Onopordium acanthium, Hypochæris glabra, Sonchus oleraceus, Cryptostemma calendulacea, Picris hieracioides, Anagallis arvensis, Plantago lanceolata, Lithospermum arvense, Lolium perenne, L. temulentum, Hordeum murinum, Bromus sterilis, B. mollis, Briza minor, Phalaris Canariensis, P. minor, Festuca rigida, F. elatior (?), Poa annua and Avena fatua. Marrubium vulgare, Celsia cretica and Solanum sodomæum have also become naturalized.

Inter-provincial Relationships.

The florula of Kangaroo Island is made up of:—

Peculiar species	11
Cosmopolitan species	55
Australian species	349
Total	415

The very large proportion of continental species—about 97 per cent.—indicates that the island from a botanical point of view has not long been isolated. And it is obvious, that we should turn our attention to the flora of the adjacent parts of the mainland to elucidate this former connection.

Of the 348 Australian species inhabiting Kangaroo Island, 186 form part of the West Australian flora, 335 occur in South Australia, 203 in Tasmania, and 309 in Victoria.

By numbers only, it is clear, that the plants of Kangaroo Island have the greatest specific identity with those of South Australia. Of the twelve Australian species, not yet found on the mainland of South Australia, seven are proper to the south-east part of Australia including Tasmania; one also is Victorian only, and two belong to West Australia. On the whole, Kangaroo Island contains a larger number of south-east species than any other part of South Australia, excepting the Mount Gambier district, which is botanically a part of Southern Victoria. In Kangaroo Island we have the meeting ground of West Australian and Tasmanian species, which here find their eastern and western limits respectively. Of the eastern species not less than 68 do not pass beyond the meridian of St. Vincent Gulf on the mainland; whilst *Daviesia incrassata*, *Pomaderris obcordata*, *Adenanthos sericeus*, *Styphelia striata*, are not known west of Kangaroo Island. It is also worthy of remark, that among the commonest species in Kangaroo Island there are 21 of West Australian origin, eleven of which do not extend to the Victorian frontier, eight

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passing over the boundary, and two—*Lasiopetalum discolor* and *Trachymene heterophylla*—common to Western Australia, South Australia and Tasmania.

Thus Kangaroo Island, occupying a median position between the western and eastern phytogeographic regions, partakes a little of the character of each mingled with South Australian plants.

The affinity of the flora of Kangaroo Island with that of South Australia is strongly shown by the presence of *Ptilotus Beckeri, Correa decumbens, Dodonæa humilis, Pultenæa acerosa, Acacia dodonæifolia, Darwinia micropetala, Eucalyptus cosmophylla, Cryptandra spathulata, Scævola linearis, Eremophila Behriana, Styphelia patula, S. concurva, Xanthorrhoea quadrangulata, Schœnus Tepperi*, fourteen in all. These and the restricted species make up a total of 25 peculiarly South Australian, which occur on the island.

COMPARISON OF THE FLORA WITH THAT OF SOUTH AUSTRALIA.

The greatest similarity subsists between the florula of Kangaroo Island and that of the elevated tracts of the Adelaide chain, and more particularly with that of the region about the source affluents of the Rivers Finniss and Hindmarsh. Here at elevations of from 800 to 1,000 feet are extensive peaty morasses—such as the Square Waterhole, Black and Hungry Swamps, embayed amidst a range of hills attaining to about 2,000 feet elevation. Much of the lower slope of the range is clothed with a thicket of heathy plants and shrubs, whilst the higher parts are covered with stringybark forests. Like Kangaroo Island, this region is rich in south-eastern species, many of which do not cross the summit of the Adelaide chain. The general aspect of the vegetation is the same, and though many of the characteristic plants are in common, yet not a few are representative and not identical. Such are—

Mount Lofty Range.	*Kangaroo Island.*
Adenanthos sericeus	A. terminalis
Correa speciosa (typica)	C. speciosa (glabra)
Prostanthera Behriana	P. coccinea
Xanthorrhœa semiplana	X. quadrangulata
Spyridium obovatum	S. halmaturinum
Melaleuca squamea	M. squarrosa
Eucalyptus Gunnii	E. corynocalyx

The arboreous and shrubby vegetation of the wet heathy ground is the same in each:—*Eucalyptus capitellata, E. cosmophylla, Acacia retinodes, Casuarina distyla, Banksias, Adenanthos terminalis, Phyllota pleurandroides, Spyridium spathulatum*, and species of *Styphelia*; whilst among humbler

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plants are—*Marianthus, Micrantheum, Ixodia, Zieria, Poranthera ericoides, Caustis, Lomaria* &c. One marked difference is the absence in Kangaroo Island of Pultenæas (except in three species occurring rarely), so abundant specifically and individually on the Mount Lofty Range, whilst on the other hand Kangaroo Island is rich in species of heathy Myrtaceæ as *Darwinia, Lhotzkya* and *Thryptomene*, which are unrepresented on the Mount Lofty Range.

Another similarity is with the country stretching from Lake Wangarry to the base of the Marble Range, Port Lincoln, the flora of which presents the same facies as that of Kangaroo Island, but exhibits a larger number of species of western types. Affinity with it is shown by *Eucalyptus santalifolia, E. cosmophylla, E. corynocalyx, Daviesia incrassata, Acacia dodonæifolia, Lasiopetalum Schulzeni, Prostanthera coccinea, Dodonæa Baueri, Eriostemon capitatus, Didymotheca thesioides, Ptilotus Beckeri, Atriplex prostratum, Melaleuca uncinata, Pomaderris obcordata, Cassinia lævis, Ixiolæna supina, Veronica distans, Grevillea halmaturina, Schœnus nitens* and *Cladium deustum*.

That those orders which are largely comprised of desert plants, as *Salsolaceæ, Amarantaceæ, Boragineæ, Goodenoviæ* and *Malvaceæ*, are so poorly represented is not to be wondered at; but the fewness of *Leguminosæ, Compositæ* and *Gramineæ* is a matter of surprise.

It is premature to speculate on the absence of some of the widely distributed annuals, endemic in Australia, because they may have escaped notice, from the circumstance, that no extended exploration has been conducted at their chief season of growth, or in localities most favourable to them. Nevertheles, the absence of *Ranunculus lappaceus, Linum marginale, Minuria leptophylla, Craspedia Richei, Microseris Fosteri, Helichrysum apiculatum, Anthistiria ciliata* and many others can be explained only on the assumption that the area was isolated before immigration. Or take the case of *Loranthus pendulus*, what has barred its admission into the island, when the species of *Cassytha*, presenting apparently no greater advantages for conveyance, have gained possession? The same remarkable circumstance is a feature of the Tasmanian flora, which includes the same three *Cassythas*, but not one *Loranthus*. These facts suggest the inquiry by what species of animals these parasitic plants are conveyed from one place to another; and then as a corollary, does the geographic distribution of those agents accord with that of the plants?

Peculiarity of Habit of some Species.

Because of the humidity and extreme mildness of the climate

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of Kangaroo Island, we find brought together at little above sea level plants, which only a few miles to the northward are relegated to various zones of considerable elevation relatively. This kind of association is well seen at the Stun'sail-boom River and at the Cygnet River. It is also worthy of notice, that several of the species have habits considerably different from those, which they have on the mainland. *Eucalyptus capitellata* is always shrubby, whilst *E. cosmophylla* in moist, sheltered situations attains to a height of 25 feet, with a stem three feet in girth. *E. obliqua* is only known as a small scraggy tree. *Melaleuca uncinata*, on the margin of the subsaline plain at the Cygnet River, towers up in pyramidal shape to fifteen feet, and *M. pustulata* forms a dense forest-growth in protected situations about D'Estrees Bay. *Banksia marginata* is always shrubby, but *Xanthorrhœa quadrangulata* acquires unusual dimensions, the trunks being not infrequently bifurcate, and rarely trifurcate, and in a few instances I have seen them with four crowns.

It cannot, I think, be questioned that the climate is suitable for the growth of exotics of the colder temperate regions, and such of those of the warm temperate regions, which require equable conditions of heat and moisture. The experimental culture of the tea-plant, as suggested by Baron Sir F. von Mueller, might engage the attention of the Commissioner of Crown Lands and the Conservator of Forests.

The effect of the battering action of the sea-moistened winds on the plants, living on the exposed cliffs of the south coast is to produce growths which at first sight are difficult to recognise specifically. In general there results a prostrate habit, and the development of thick fleshy leaves. The species in which this effect is conspicuously seen is *Ixodia achilleoides*, which from a slender shrubby herb of about three feet high, with long linear leaves in favourable situations, here presents a dense carpet of a few inches thick, covering the stony surfaces on the summits of the sea-cliffs, the leaves ovate-spathulate, thick and fleshy, half an inch long. Here *Podolepis rugata* becomes stemless, and *Apium prostratum* and *Lobelia anceps* are minute prostrate plants. *Euphrasia Brownii*, *Aster Huegelii*, *Senecio lautus*, *Samolus repens* and *Plantago varia* are also much altered in appearance.

Comparative Statistics.

Of the 416 species admitted as indigenous to Kangaroo Island, there are:—Dicotyledoneæ, 326; Monocotyledonæ, 84; Vascular Cryptogams, 6. The ratio of the Monocotyledons to the Dicotyledons, being 1 to 4, approximates closely to that for the flora of Australia, which is 1 to 4·53, rendered excep-

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tionally high from the overwhelming number of Dicotyledons in West Australia. The ratio of the two classes in that flora is 1 to 5·3, and that for Kangaroo Island comes nearer to it than any provincial flora. This high ratio is the more remarkable when examined from a geographical point of view. It contrasts most markedly with that of Tasmania, with which it has many specific points of contact, the ratio for Tasmania being 1 to 2·6; whilst South Australia, which claims 97 per cent. of its species, the ratio is 1 to 3·7.

The sequence of the ordinal groups, according to predominance of their numbers of species, is as follows:—Compositæ, 43; Myrtaceæ, 33; Leguminosæ, 27; Cyperaceæ, 24; Gramineæ, 20; Umbelliferæ, 14; Epacrideæ, 11; Proteaceæ, 11. These orders are also the first seven in a like arrangement for the Australian flora, though their relative positions are not the same. In the South Australian flora, Proteacæ and Epacrideæ give place to Salsolaceæ and Orchideæ; and in Tasmania, Orchideæ and Filices replace Myrtaceæ and Proteaceæ; but in West Australia the similarity is greater, inasmuch as Gramineæ occupies the eighth place, being deposed from the seventh by Goodenovieæ, and Myrtaceæ stands second, the same position it occupies in the Australian list and in that of Kangaroo Island.

The remarkable morphological diversity is indicated by the presence of 230 genera, belonging to 69 orders; so that the ratio of genera to species is 1 to 1·8; whereas for the Australian flora it is 1 to 6·4 nearly, and for South Australia 1 to 3·6, and for Tasmania 1 to 2·6, the lowest among the provincial floras.

The genera containing more than three species to each are:—Eucalyptus, 14; Acacia and Styphelia, 11; Pimelea, 9; Melaleuca and Hydrocotyle, 7; Cryptandra and Scirpus, 6; Aster, Helichrysum, Schœnus, 5; Hibbertia, Lasiopetalum, Drosera, Triglochin and Leptospermum, 4.

CONCLUSIONS RESPECTING RELATIONSHIP OF THE FLORA.

1. The small number of peculiar species does not entitle Kangaroo Island to the rank of a botanical region.

2. The large proportion of its species being common to the mid-southern districts of South Australia, Kangaroo Island becomes a part of that botanical region.

3. The number of its peculiar species and those of Tasmanian origin entitle it to a subregional rank.

4. The absence of a large number of species, alien and endemic, widely spread over the continent would seem to imply isolation before immigration of the extra-Australian species and those endemic ones of marked exotic genera to the shores

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of the adjacent mainland. The isolation was, without doubt, subsequent to that of Tasmania, though prior to the advent of man in Australia, botanical isolation being secured against man's aggression by reason of his inability to cross the Straits.

Catalogue of the Flowering Plants and Ferns, with Localities.

The sequence of the orders and the nomenclature of the species are adopted from Baron Sir F. von Mueller's "Systematic Census of Australian Plants;" and to that gentleman I am greatly indebted for the revision of the specific determinations. The plant-names to which an asterisk is prefixed are now published for the first time.

RANUNCULACEÆ.

*Ranunculus parviflorus. Mossy banks in gullies near Kangaroo Head.

*Clematis microphylla. Common near the coast.

DILLENIACEÆ.

*Hibbertia densiflora. Heath near American River.

*Hibbertia stricta. Common on sandy and stony heath-ground.

*Hibbertia Billardieri. Not uncommon on sandy heath-ground.

*Hibbertia fascicularis. Wet heath-ground three miles east from Karatta; also at the Harriet River.

LAURINEÆ.

Cassytha glabella, Kang. I., *Sealey*. Sandy heath-ground, parasitic on *Lepidosperma filiforme* chiefly.

*Cassytha melantha. Parasitic on the smaller Eucalypts chiefly.

*Cassytha pubescens. Parasitic on small heathy shrubs and *Melaleuca uncinata*.

PAPAVERACEÆ.

*Papaver aculeatum. Sandhills at American Beach, and rocky ground northward to Kangaroo Head; Kingscote; D'Estrees Bay.

CRUCIFERÆ.

*Capsella procumbens. Rocks by the sea and moist gullies, North Dudley Peninsula; also in ti-tree thickets bordering salt lake near Pelican Lagoon.

*Cakile maritima. Sandy shore of D'Estrees Bay.

Lepidium foliosum. Kang. I., *Bannier*.

*Lepidium ruderale. Chiefly by the sea, Dudley Peninsula; Flour Cask Bay, Eleanor River, Kingscote and Bay of Shoals.

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VIOLACEÆ.

Viola hederacea. Kang. I., *Waterhouse*, in Frag. Phyt., x., 82.

PITTOSPOREÆ.

Pittosporum phillyroides. Kang. I., *Waterhouse*. Sea cliffs east side of Bay of Shoals; about Salt Lagoon.

*Marianthus bignoniaceus. Thickets under the shade of Sugar-gum trees at the Harriet and Stun'sail-boom Rivers.

*Bursaria spinosa. Sandhills, Hog Bay; shady banks of the Hog Bay, Cygnet, Harriet and Stun'sail-boom Rivers.

Billardiera cymosa. Kang. I., *Waterhouse*. Bushy places throughout Dudley Peninsula, and at Kingscote, American River, Harriet and Stun'sail-boom Rivers, and occasionally in open heath-ground.

Cheiranthera linearis. Kang. I., *Waterhouse*.

Cheiranthera volubilis. Scrub in Kang. I., *Waterhouse*.

DROSERACEÆ.

*Drosera pygmæa. Sandy heath-ground, central Dudley Peninsula.

*Drosera Whittakerii. Dudley Peninsula, *R. S. Rogers!*; wet sandy heath-ground near D'Estrees Bay.

*Drosera auriculata. Heathy tracts, central Dudley Peninsula, near D'Estrees Bay and Kingscote.

*Drosera Menziesii. Heath-ground near D'Estrees Bay; near Kingscote, *R. S. Rogers!*

HYPERICINÆ.

*Hypericum Japonicum. Growing among rocks on the upland country about American Beach.

POLYGALEÆ.

*Comesperma volubile. Bushy places in the south parts of Dudley Peninsula, Western Cove, Kingscote and Salt Lagoon.

Comesperma calymega. Kang. I., *Waterhouse*. Wet sandy-heath ground. Central Dudley Peninsula and near D'Estrees Bay.

Comesperma polygaloides. Kang. I., *Waterhouse*.

TREMANDREÆ.

Tetratheca ericifolia. Kang. I., *Heuzenroeder* in Frag. Phyt., xii., 6.

STERCULIACEÆ.

Thomasia petalocalyx. Kang. I., *Waterhouse*. Heathy ground chiefly. American River; near D'Estrees Bay; at the Harriet, Eleanor, and Stun'sail-boom Rivers, by the Cygnet River, and towards Freestone Range.

Lasiopetalum discolor. Kang. I., *Waterhouse*. Heath-ground, near Kingscote.

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Lasiopetalum Behrii. Kang. I., *Waterhouse.*

Lasiopetalum Bauerii. Kang. I., *Waterhouse.* Heathy and stony ground, Dudley Peninsula, and westward to Kingscote and Stun'sail-boom River.

Lasiopetalum Schulzeni. Kang. I., *Waterhouse.* Sand-dunes and stony ground near Rocky Point, American Beach; heathy ground, American River, and elsewhere near the coast; rarely in the interior parts of the island.

MALVACEÆ.

*Lavatera plebeia. On the loam-lands by the Hog Bay River.

*Plagianthus spicatus. On stiff clay soil, after burning of the brushwood, at Salt Lagoon, Emu Creek, and between Kingscote and Cygnet River.

GERANIACEÆ.

*Geranium Carolinianum. Common in shady places and thickets on Dudley Peninsula.

Erodium cygnorum. Kang. I., in *Fl. Austral.*

*Pelargonium australe. Shady places and sand-dunes, Dudley Peninsula. Var. *erodioides.* Sandy ground about Kingscote, American River, D'Estrees Bay, Mount Mary, and Dudley Peninsula.

*Oxalis corniculata. Shady banks of Cygnet River, *R. S. Rogers!* and *Tate.* Common in gullies and open places in thickets on Dudley Peninsula.

ZYGOPHYLLEÆ.

Zygophyllum Billardieri. Kang. I., *R. Brown.* Cliffs by the sea, D'Estrees Bay.

Nitraria Schoberi. Kingscote Point, *Waterhouse, Tate.* Rocks by the sea to the north of American Beach.

RUTACEÆ.

Zieria veronicea. Kang. I., in *Fl. Austral.* Heath between American River and D'Estrees Bay.

*Boronia cœrulescens. Heath between American River and D'Estrees Bay.

Boronia filifolia. Kang. I., *Waterhouse* in Frag. Phyt., ii., 177. Heath near D'Estrees Bay, Hawk's Nest, and Mount Pleasant, to the Stun'sail-boom River. Dudley Peninsula, *T. Willson!*

*Eriostemon capitatus. Sea cliffs, D'Estrees Bay; on the calciferous sandstone between Mount Pleasant and the Eleanor River.

*Correa speciosa. Cygnet River, *R. S. Rogers!* and *Tate.* Creek between Birchmore and White Lagoons; at the Eleanor, Harriet and Stun'sail-boom Rivers. Sandhills at Mount Mary.

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Correa alba. Kang. I., *Waterhouse*. Throughout Dudley Peninsula. Kingscote, *R. S. Rogers!* Cygnet River, and Western Cove to American River.

Correa decumbens. Kang. I., *Waterhouse*.

*Geijera parviflora. Sea cliffs, Kingscote Point and Bay of Shoals.

EUPHORBIACEÆ.

*Poranthera ericoides. Heath near D'Estrees Bay, at White Lagoon, and between Mount Pleasant and Eleanor River.

*Poranthera microphylla. Shady places throughout Dudley Peninsula and at American River.

*Micrantheum hexandrum. Heath, on ironstone-gravel, between the Harriet and Eleanor Rivers.

Beyeria opaca. Kang. I., *R. Brown*. Common on sandy and stony heath-ground, bushy places, and by the sea coast.

Bertya rotundifolia. Cygnet River, *Waterhouse*. Heath-ground from Kingscote to American River and Stun'sail-boom River.

*Phyllanthus australis. Sandy ground at White Lagoon and Eleanor River.

*Phyllanthus thymoides. Heath, Central Dudley Peninsula.

Adriana quadripartita. Kang. I., *Waterhouse*. Banks of the Hog Bay River; sandhills at Mount Mary.

URTICACEÆ.

*Urtica incisa. Banks of the Lower Cygnet River.

Parietaria debilis. Kang. I., *Fl. Austral.* Rocky gullies and shady places throughout Dudley Peninsula.

CASUARINEÆ.

Casuarina quadrivalvis. Kang. I., *Waterhouse*. By the coast, at Salt Lagoon, Kingscote Point, Western Cove, American River; north coast of Dudley Peninsula and Hog Bay River.

Casuarina distyla. Kang. I., *Waterhouse*. Forming thickets on sandy heath-ground, Cygnet River to D'Estrees Bay and Stun'sail-boom River; Central Dudley Peninsula.

SAPINDACEÆ.

Dodonæa viscosa. Kang. I., *Sealey*, *Waterhouse*. Chiefly in th form *attenuata*. Coast shrubs, Kingscote; Western Covee American River, Hog Bay River, American Beach. Also, thickets in the elevated interior parts as between Birchmore's and White Lagoon, along the banks of the south-western rivers, and North Dudley Peninsula.

*Dodonæa Baueri. Sandy heath-ground about Kingscote and to Emu Creek; American River.

*Dodonæa humilis. Sandy heath, near D'Estrees Bay. Sand-

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hills and on calciferous sandrock, Eleanor River, Hog Bay River to Rocky Point, American Beach.

STACKHOUSIEÆ.

*Stackhousia linarifolia. Kingscote and Eleanor River; *var.?* wet sandy heath near D'Estrees Bay.

FRANKENIACEÆ.

*Frankenia lævis. Saline swamps, Bay of Shoals and Nepean Bay; margins of salt lagoons about Flour-cask Bay and Pelican Lagoon.

PORTULACEÆ.

*Claytonia volubilis. Among rocks, north coast of Dudley Peninsula.

*Claytonia calyptrata. Rocky shady places about Kangaroo Head; gorge of the Hog Bay River.

CARYOPHYLLEÆ.

*Stellaria glauca. Among rocks by the sea, Christmas Cove, and gullies North Dudley Peninsula; under shade of gum trees, Hog Bay River.

*Sagina apetala. Western Cove, Nepean Bay. Common throughout Dudley Peninsula, especially near the coast.

*Spergularia rubra. Cliffs slopes by the sea, north coast of Dudley Peninsula.

*Spergularia marina. Saline swamps, Bay of Shoals and Nepean Bay. Along the courses of the salt-water creeks, North Dudley Peninsula.

AMARANTACEÆ.

*Polycnemon pentandrum. Saline swamp at the head of Bay of Shoals; around shore of salt lagoon to the east of Pelican Lagoon.

*Ptilotus Beckeri. On ironstone gravel, after fire, about Mount Pleasant and hence to the Eleanor River.

*Alternanthera triandra. Banks of the Cygnet River immediately above tidal influence.

SALSOLACEÆ.

Rhagodia crassifolia. Kang. I., *R. Brown.* Sea cliffs and salt swamps from American River to Bay of Shoals; littoral tracts of North and West Dudley Peninsula.

Rhagodia nutans. Kang. I., *R. Brown.* Rocks by the sea north coast of Dudley Peninsula and to American Beach.

Chenopodium carinatum. Kang. I., *R. Brown* (as *C. pumilio*, R. Br.). Grassy slopes by the sea, north coast of Dudley Peninsula.

Atriplex paludosum. Kang. I., *R. Brown, Waterhouse.* Saline swamps head of the Bay of Shoals; rocks at high-water

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mark north coast of Dudley Peninsula to American Beach.

Atriplex cinereum. Kang. I., *Waterhouse*. Kingscote Point and Bay of Shoals; Hog Bay and American Beach.

Atriplex prostratum. Kang. I., *R. Brown*.

*Kochia oppositifolia. Rocks by the sea between Penneshaw and Kangaroo Head.

*Enchylæna tomentosa Sea cliffs, Kingscote; Christmas Cove and American Beach, Dudley Peninsula.

*Salicornia arbuscula. Salt swamps, Nepean Bay, American River; Christmas Cove.

*Salicornia australis. Salt swamps, common.

*Suæda maritima. Rocks by the sea, north coast of Dudley Peninsula; sandhills, American Beach and Hog Bay.

FICOIDEÆ.

*Mesembrianthemum australe. Saline swamps, Bay of Shoals and Nepean Bay; and wet rocks by the sea north coast of Dudley Peninsula.

*Mesembrianthemum æquilaterale. Sand-dunes, common.

*Tetragonia implexicoma. D'Estrees Bay; rocks by the sea north and west coasts of Dudley Peninsula.

POLYGONACEÆ.

Muehlenbeckia adpressa. Kang. I., *Waterhouse*. Bushy places and heath-ground; especially near the sea; mallee scrub and thickets throughout Dudley Peninsula.

Rumex Brownii. Kang. I., *Huezenroeder*. Cygnet River; pastures and thickets throughout Dudley Peninsula.

PHYTOLACCEÆ.

Didymotheca pleiococca. Kang. I., *Waterhouse*. Heath between American River and D'Estrees Bay; between White Lagoon and Hawk's Nest, and towards the Eleanor and Stun'sail-boom Rivers.

*Didymotheca thesioides. Chiefly on calciferous sandstone formation, from Hog Bay River to Rocky Point, American Beach.

LEGUMINOSÆ.

Gompholobium minus. Kang. I., *Waterhouse*. Heath between American River and D'Estrees Bay; by watercourse between Birchmore Lagoon and Mount Pleasant.

*Daviesia genistifolia. Heath near Kingscote; between Eleanor and Stun'sail-boom Rivers, and central Dudley Peninsula.

Daviesia incrassata. Kang. I., *Waterhouse*. Karatta.

*Daviesia brevifolia. Heath between American River and D'Estrees Bay; towards the Eleanor River.

Phyllota pleurandroides. Kang. I., *Waterhouse*. Heath south

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side of Cygnet River; thence common to D'Estrees Bay and Stun'sail-boom River.

*Pultenæa acerosa. Heath near D'Estrees Bay and Central Dudley Peninsula.

*Pultenæa *(aff)* hibbertioides. Sugar-gum tree forests at Karatta.

Pultenæa tenuifolia. Kang. I., *Bannier*.

*Eutaxia empetrifolia. Kingscote; Mount Pleasant to Eleanor and Harriet Rivers. Heath, Central Dudley Peninsula and on stony ground by Hog Bay River.

Dillwynia floribunda. Kang. I., *Waterhouse*. Heath near D'Estrees Bay. Dudley Peninsula, *T. Willson!*

Platylobium obtusangulum. Kang. I., *Waterhouse*. Common from the Eleanor River to Karatta.

Goodia medicaginea. Kang. I., *Waterhouse* in Frag. Phyt., ix., 157. Kingscote, Cygnet River. Open part of mallee scrub, and thickets throughout Dudley Peninsula.

Lotus australis. Kang. I., *Waterhouse*. Coast cliffs at Hog Bay River.

*Swainsonia lessertiifolia (*forma normalis*). On sandy ground near the sea, Hog Bay, American Beach to Hog Bay River; American River; sandy banks of the Eleanor River, Mount Mary.

*Kennedya monophylla. Thickets southward of Rocky Point, Dudley Peninsula; American River.

*Kennedya prostrata. Mount Pleasant to Eleanor River.

*Acacia spinescens. Heath, Central Dudley Peninsula.

*Acacia rupicola. On calciferous sandstone at Mount Mary; thickets at Karatta.

*Acacia verticillata. Heath near Karatta.

Acacia calamifolia. Kang I., *Fl. Austral.* Sandy ground, Bay of Shoals, south of Cygnet River, and White Lagoon.

Acacia armata. Kang. I., *R. Brown*. Common throughout the island, forming dense thickets on the calciferous sand-rock formation.

*Acacia microcarpa. Stony ridge between Rocky Point and Salt Lagoon, Dudley Peninsula.

Acacia dodonæifolia. Kang. I., *Baudin's Exped.*

Acacia retinodes. Kang. I., *Waterhouse*. Constituting dense thickets along line of water courses in the south-western parts. Sandhills around Vivonne Bay and Hog Bay River.

*Acacia pycnantha. Open scrub lands North Dudley Peninsula.

*Acacia brachybotrya. Murray's Lagoon.

Acacia farinosa. Kang I., *Waterhouse*.

ROSACEÆ.

*Rubus parvifolius. Loamy banks of the Hog Bay River.

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*Acæna ovina. Pasture slopes by the sea, south of Kangaroo Head.

Acæna sanguisorbæ. Kang I., *R. Brown.* Open lands and shady places, chiefly near the sea. Dudley Peninsula, Kingscote, &c.; Mount Pleasant to the Stun'sail-boom River.

CRASSULACEÆ.

*Tillæa verticillaris. Rocks, shaded gullies, and sand-dunes, Dudley Peninsula; Bay of Shoals and Western Cove.

*Tillæa recurva. Eleanor River.

*Tillæa macrantha. Mossy banks in the gullies of North Dudley Peninsula.

ONAGREÆ.

*Epilobium tetragonum. Inundated ground, throughout Dudley Peninsula; Discovery Flat, Cygnet River, Hawk's Nest and American River.

HALORAGEÆ.

Loudonia Behrii. Kang. I., *Waterhouse.* Sandy heath-ground, American River to Karatta.

Haloragis mucronata. Kang. I., *R. Brown.*

*Haloragis tetragyna. Discovery Flat.

*Haloragis teucrioides. Stony and sandy heath-ground, Kingscote to D'Estrees Bay and Eleanor River. Central Dudley Peninsula.

*Myriophyllum elatinoides. Cygnet River.

*Myriophyllum variifolium. Eleanor and Stun'sail-boom Rivers.

MYRTACEÆ.

Darwinia micropetala. Kang. I., *Bannier.*

Calycothrix tetragona. Kang. I., *Fl. Austral.* Coast scrubs chiefly, Kingscote, Bay of Shoals, American River, Mount Pleasant to Karatta. Hog Bay River.

Lhotzkya glaberrima. Kang. I., *Bannier.* Sandy heath ground near D'Estrees Bay, and from Mount Pleasant to Karatta.

Thryptomene ericæa. Kang. I., *Bannier, Waterhouse.* Heath near Kingscote and American River.

*Thryptomene ciliata. Heath ground White Lagoon, Mount Pleasant, to Stun'sail-boom River.

Bæckea crassifolia. Kang. I., *Waterhouse.*

*Kunzea pomifera. Sandhills, Vivonne Bay.

Leptospermum lævigatum. Kang. I., *Frag. Phyt.*, iv., 60.

Leptospermum scoparium. Kang. I., *Waterhouse.* Common on the wet sandy heaths of the main mass of the island.

Leptospermum myrsinoides. Kang. I., *Waterhouse.* Stun'sail-boom River.

*Leptospermum lanigerum. Thickets along the margins of the south-western rivers.

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Callistemon coccineus. Kang. I., *Fl. Austral.* Claypans throughout the island; Hog Bay River; heath-ground Central Dudley Peninsula.

Melaleuca acuminata. Kang. I., *R. Brown, Waterhouse.* Sandy ground, Kingscote. Common throughout Dudley Peninsula.

Melaleuca gibbosa. Kang. I., *Waterhouse.* Common on heathy ground and around claypans.

Melaleuca squarrosa. Kang. I., *R. Brown.*

Melaleuca cylindrica. Kang. I., *R. Brown.*

Melaleuca uncinata. Kang. I., *Waterhouse.* Chief constituent of the sandy heath-ground. Central Dudley Peninsula.

Melaleuca parviflora. Kang. I., *Waterhouse.* Kingscote to the Freestone Range; Mount Mary. Common throughout Dudley Peninsula, except on the sandy heath-ground.

Melaleuca pustulata. Kang. I., *Waterhouse.* Salt swamps and by the sea generally distributed; Murray's Lagoon and around subsaline claypans or "ti-tree flats" about Mount Pleasant.

*Eucalyptus capitellata. On the high sandy ground between Mount Pleasant and the Stun'sail-boom River.

Eucalyptus santalifolia. Kang. I., *R. Brown.* Chiefly near the coast around Dudley Peninsula, at the Cygnet River, American River and White Lagoon.

*Eucalyptus obliqua. On the dividing ridge between Birchmore Lagoon and Mount Pleasant.

*Eucalyptus gracilis. Stony heath-ground from Mount Pleasant to the Stun'sail-boom River.

Eucalyptus hemiphloia. Kang. I., *R. Brown.* The Wells, Western Cove, Nepean Bay.

Eucalyptus paniculata. Banks of the Cygnet River, *Waterhouse.*

Eucalyptus largiflorens. Cygnet River, *Waterhouse.*

*Eucalyptus Leucoxylon. Grassy flats on the western and southern parts of Dudley Peninsula; Twelve-tree Flat, between Bay of Shoals and Cygnet River; banks of Cygnet, Eleanor and Stun'sail-boom Rivers.

*Eucalyptus corynocalyx. Freestone Hill Range; American River, on alluvium; chief constituent of the forest-growth on the Cygnet, Eleanor and other Rivers.

Eucalyptus cneorifolia. Kang. I., *R. Brown.* Northern and western parts of Dudley Peninsula, and westward along north coast to Smith's Bay.

Eucalyptus cosmophylla. Kang. I., *Waterhouse.* A chief constituent of the scrub, on stony ground, from the Cygnet River to American River, and Stun'sail-boom River.

Eucalyptus incrassata. Kang. I., *Baudin's Exped.* Freestone

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Hill Range; rocky shores of Bay of Shoals and American River; Eleanor River. The varietal form *dumosa* constituted the chief mass of the mallee scrub throughout the island.

Eucalyptus viminalis, Kang. I., *R. Brown*. Cygnet River among *E. corynocalyx*.

Eucalyptus rostrata. Cygnet River, *Waterhouse*, *Tate*; Discovery Flat.

RHAMNACEÆ.

Pomaderris apetala. Kang. I., *Waterhouse*.

*Pomaderris racemosa. Heath-ground about American River and Mount Mary; sandy tracts near Rocky Point, American Beach. *Var.* Shady banks of the Cygnet River; gorge of the Hog Bay River, and Deep Creek, Dudley Peninsula.

*Pomaderris obcordata. Sand-dunes, Mount Mary; stony ridge between American Beach and Salt Lagoon, Dudley Peninsula.

*Spyridium obovatum. Forest on the Stun'sail-boom River.

Spyridium spathulatum. Kang. I., *Waterhouse*. Heaths, Kingscote, American River, &c., to the Stun'sail-boom River; Central Dudley Peninsula.

Spyridium halmaturinum. Kang. I., *Sealey*. Freestone Hill Range, *Waterhouse*. Western Cove to American River and D'Estrees Bay; Cygnet River to the south-west coast. Sandy ground near Rocky Point, Dudley Peninsula.

*Spyridium vexilliferum. American River and Kingscote.

Spyridium leucophractum. Kang. I., *Waterhouse*, in Frag. Phyt., iii., 77. On calciferous sandstone towards the Eleanor River.

Spyridium Waterhousei. At the foot of the Freestone Hill Range, *Waterhouse*, in Frag. Phyt., iii., 83. Heath-ground, American River, White Lagoon, thence to the forest of sugar-gum trees at Karatta. Heath-ground, Central Dudley Peninsula.

UMBELLIFERÆ.

*Hydrocotyle hirta. Thickets, White-Gum Gully, Dudley Peninsula.

*Hydrocotyle laxiflora. Under *Eucalyptus leucoxylon*, in the gorge of the Hog Bay River.

*Hydrocotyle tripartita. Shady banks of the Cygnet, Eleanor, and Stun'sail-boom Rivers.

*Hydrocotyle crassiuscula, n. sp., allied to *H. trachycarpa*. Heath-ground, Central Dudley Peninsula.

*Hydrocotyle callicarpa. Mossy banks in gullies, under shade of thickets, and wet heath-ground, Dudley Peninsula.

Hydrocotyle capillaris. Kang I., *Fl. Austral.* Wet banks of

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creeks, Dudley Peninsula; on burnt heath-ground, Central Dudley Peninsula.

*Hydrocotyle Asiatica. Wet banks of the Cygnet and Eleanor Rivers.

*Didiscus pusillus. Sandy ground, under the shade of shrubs, near Rocky Point, Dudley Peninsula.

*Trachymene heterophylla. Heath-ground between American River and D'Estrees Bay, White Lagoon, and Eleanor River.

Xanthosia dissecta. Kang. I., *Fl. Austral.* Heath near American River and at the Eleanor River.

*Eryngium vesiculosum. Inundated ground, Birchmore's Lagoon, and at Hawk's Nest; wet banks of the Eleanor and Stun'sail-boom Rivers.

*Apium prostratum. Salt Lagoon, Bay of Shoals, &c.; sea cliffs on the south coast; wet banks of Cygnet, Eleanor, and other rivers. Generally distributed throughout Dudley Peninsula.

*Crantzia lineata. Mud-banks of the Cygnet and Eleanor Rivers.

*Daucus brachiatus. Open places, Emu Creek, Kingscote, Western Cove, American River, and widely distributed throughout Dudley Peninsula.

SANTALACEÆ.

Choretrum glomeratum. Kang. I., *Waterhouse.* Common on sandy heath-ground, Bay of Shoals and Kingscote to D'Estrees Bay and Stun'sail-boom River; Central Dudley Peninsula.

Choretrum spicatum. Kang. I., *Bannier.*

*Leptomeria aphylla. Heath-ground near the Eleanor River and at Karatta.

Exocarpos cupressiformis. Kang. I., *Waterhouse.* Thickets on the Stun'sail-boom River; sparsely distributed throughout the Dudley Peninsula.

PROTEACEÆ.

Petrophila multisecta. Kang. I., *Waterhouse*, in Frag. Phyt., vi., 242. Heaths, from Cygnet River eastward to American River, and south-west to the Stun'sail-boom River.

Adenanthos sericea. Kang. I., *Waterhouse.* Heath lands, from Cygnet River to Redbanks, American River and D'Estrees Bay, thence to the Eleanor River, &c.

Adenanthos terminalis. Kang. I., *Fl. Austral.;* with the last.

Conospermum patens. Kang. I., *Waterhouse.* Wet sandy heath near D'Estrees Bay, north of Mount Pleasant and near Karatta.

Grevillea parviflora, *var.?* Kang. I., *Waterhouse.* Forest on the Stun'sail-boom River at Karatta.

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Grevillea ilicifolia. Kang. I., *Waterhouse.* Kingscote, south of Cygnet River, American River, and White Lagoon to Eleanor River.

Hakea rostrata. Kang. I., *Fl. Austral.* American River, and along the south coast. Heath, Central Dudley Peninsula

Hakea rugosa. Kang. I., *Waterhouse.* Sandy heath-ground, American River to D'Estrees Bay; and along south coast. Central Dudley Peninsula, *R. S. Rogers!*

Hakea flexilis. Kang. I., *Waterhouse.* Between the salt lagoons west of Bay of Shoals; forming dense thickets on sandy ground, south of Cygnet River to Birchmore Lagoon; Murray Lagoon, thence to Karatta.

Banksia marginata. Kang. I., *Waterhouse.* Sandy heath-ground, from the Cygnet River to D'Estrees Bay, and the Stun'sail-boom River.

Banksia ornata. Kang. I., *Frag. Phyt.*, vii., 56. Wet sandy ground between Cygnet River and Birchmore Lagoon, between American River and D'Estrees Bay; White Lagoon, and frequently to the Stun'sail-boom River.

THYMELEÆ.

*Pimelea spathulata. Heath, near American River; Kingscote, *R. S. Rogers!* Common throughout Dudley Peninsula.

Pimelea ligustrina. Sandy scrub, Kang. I., *Waterhouse*, in Frag. Phyt., vii., 5. Hawk's Nest and Eleanor River.

Pimelea microcephala. Kang. I., *R. Brown.*

*Pimelea serpyllifolia. Kingscote, *R. S. Rogers!* Heath, between American River and D'Estrees Bay; sand-dunes, Vivonne Bay; coast tracts, Dudley Peninsula.

Pimelea flava. Kang. I., *Waterhouse*, in Frag. Phyt., vii., 6. Heath, near American River; Mount Pleasant to the Eleanor River; Central Dudley Peninsula.

Pimelea octophylla. Kang. I., *Waterhouse.* Heaths, on stony or sandy ground by the Cygnet River; Redbanks to American River and D'Estrees Bay, and along south coast.

*Pimelea curviflora. On calciferous sandstone, Hog Bay River.

*Pimelea phylicoides. Heath, between American River and D'Estrees Bay.

Pimelea stricta. Kang. I., *Heuzenroeder*, in Frag. Phyt., vii., 4.

RUBIACEÆ.

*Opercularia varia. Heath ground, Central Dudley Peninsula

Galium australe. Kang. I., *Fl. Austral.* Western Cove; thickets Dudley Peninsula.

*Galium umbrosum. Open ground, Western Cove and American River; natural pastures Dudley Peninsula.

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COMPOSITÆ.

Aster axillaris. Kang. I., *R. Brown*. Near the coast, Kingscote and American River; widely distributed, Dudley Peninsula.

*Aster floribundus. Eucalypt-forests at the Harriet, Eleanor and Stun'sail-boom Rivers.

Aster teretifolius. Kang. I., *Waterhouse*. Scrubs about American River and White Lagoon. Generally distributed throughout Dudley Peninsula.

*Aster exul. On the calciferous sandstone formation, Hog Bay River to American Beach, and American River; Kingscote, *R. S. Rogers!* Sand-dunes, Mount Mary.

Aster Huegelii. Kang. I., *Waterhouse*. American River and adjacent south coast. Stony ground between Mount Pleasant and Eleanor River.

*Vittadinia australis. Kingscote and Salt Lagoon to Discovery Flat; Murray's Lagoon; Mount Mary. Widely dispersed over Dudley Peninsula.

*Lagenophora Billardieri. Mossy banks in gullies and under shade of gum trees and thickets, Dudley Peninsula.

*Lagenophora emphysopus. Pasture slopes by the sea, south of Kangaroo Head.

*Cotula filifolia. Along courses of salt-water creeks and by the sea, northern coast of Dudley Peninsula; also clay flats in the basin of Deep Creek.

Cotula coronopifolia. Kang. I., *Waterhouse*. Cygnet River. By creeks and wet ground throughout Dudley Peninsula.

*Cotula australis. Pasture lands, under shade, throughout Dudley Peninsula; and by the coast towards Kangaroo Head.

Centipeda Cunninghami. Kang. I., *Waterhouse*. Inundated ground and river-banks, throughout the island.

*Achnophora Tatei. Wet heathy ground, two miles east from Karatta.

*Isoetopsis graminifolia. Pasture slopes by the sea south of Kangaroo Head.

Myriocephalus rhizocephalus. Kang. I., *Waterhouse*. Inundated ground, Cygnet River and Salt Lagoon.

*Angianthus Preissianus. Margins of the salt-water creeks and clay flats throughout Dudley Peninsula.

*Angianthus strictus. Pasture slopes by the sea, north and west coasts of Dudley Peninsula.

Calocephalus Brownii. Kang. I., *Fl. Austral.* Rocks by the sea, north-east coast of Dudley Peninsula, Kingscote and D'Estrees Bay.

Ixodia achilleoides. Kang. I., *Fl. Austral.* Very abundant throughout the island.

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*Cassinia lævis. Murray's Lagoon. On calciferous sandstone, Hog Bay River.

Cassinia spectabilis. Kang. I., *Fl. Austral.* On burnt ground, throughout Dudley Peninsula, American River, Kingscote and Emu Creek. Sparsely distributed as far west as the Eleanor River.

*Eriochlamys Behrii. Cliffs by the sea, D'Estrees Bay and near Hog Bay River.

*Toxanthus perpusillus. Grassy slopes by the sea, south of Kangaroo Head.

*Millotia tenuifolia. Sandy soil near the coast at Western Cove and American River. Wet banks and thickets, Dudley Peninsula.

Ixiolæna supina. Kang. I., *Fl. Austral.* Sea cliffs around Dudley Peninsula and D'Estrees Bay.

*Podosperma angustifolia. Sand-ridges shores of Western Cove, American Beach, and American River; sand-dunes at Mount Mary; on calciferous sandstone, Hog Bay River.

*Podolepis rugata. Sea-cliffs of D'Estrees Bay.

Helichrysum obtusifolium. Kang. I., *Waterhouse.* Near Western Cove, Nepean Bay; between Mount Pleasant and the Eleanor River.

*Helichrysum lucidum. Smith's Bay.

Helichrysum adenophorum. Scrub near Wallan's Hut, *Waterhouse.* Smith's Bay; heathy ground from Cygnet River to Mount Prospect, and the Stun'sail-boom River.

*Helichrysum leucopsidium. Pasture slopes by the sea, D'Estrees Bay, and towards Hog Bay River. Sand-dunes Vivonne Bay and American Beach.

*Helichrysum retusum. Heathy ground at Kingscote, and Red-banks to American River. Mallee scrub, north Dudley Peninsula; and near Rocky Point.

*Helipterum dimorpholepis. Grassy slopes by the sea, south of Kangaroo Head.

Gnaphalium luteo-album. Kang. I., *Fl. Austral.* American River and about Mount Mary. Widely dispersed over Dudley Peninsula.

Gnaphalium Japonicum. Kang. I., *Waterhouse.* Discovery Flat; White Lagoon and Eleanor River. Common on Dudley Peninsula.

*Gnaphalium indutum. Cliff-slopes on the north and west coasts, clay-flats and under shade of thickets, Dudley Peninsula.

*Stuartina Muelleri. With the last.

*Erechthites prenanthoides. Sandy ground, Cygnet River. Sparsely distributed throughout Dudley Peninsula.

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Erechthites arguta. Kang. I., *Fl. Austral.* Kingscote; Cygnet River.

*Erechthites quadridentata. Open mallee scrub, and extending to heathy ground, north Dudley Peninsula.

Senecio lautus. Kang. I., *Fl. Austral.* Sea cliffs, D'Estrees Bay to Hog Bay River, north coast of Dudley Peninsula; sand-dunes of Vivonne Bay.

Senecio odoratus. Kang. I., *R. Brown.* Bushy places, widely distributed.

*Cymbonotus Lawsonianus. Natural pasture lands and grassy glades in mallee scrub, throughout Dudley Peninsula.

CAMPANULACEÆ.

Lobelia microsperma. Kang. I., *Waterhouse.* Heaths common Cygnet River to Mount Pleasant, &c. Grassy slopes by the sea, D'Estrees Bay.

Lobelia anceps. Kang. I., *Waterhouse.* Wet banks of Hog Bay, Cygnet, Eleanor and other western rivers; sea cliffs, Hog Bay River.

*Lobelia platycalyx. Mudbanks of the Cygnet River.

*Wahlenbergia gracilis. Cygnet River and American River; common throughout Dudley Peninsula.

CANDOLLEACEÆ.

*Candollea graminifolia. Wet sandy heath, near D'Estrees Bay, and between the Harriet and Stun'sail-boom Rivers.

*Candollea calcarata. Along runnels, sandy heath-ground, Central Dudley Peninsula.

*Candollea despecta. Along runnels, clayey heath-ground, Central Dudley Peninsula.

*Leewenhœkia dubia. Grassy slopes by the sea, north-west coast of Dudley Peninsula.

GOODENIACEÆ.

Goodenia ovata. Cygnet River, *Waterhouse, Tate.* Bushy places by water-courses — American River, Eleanor, Harriet and Stun'sail-boom Rivers; mallee- and heath-scrubs, Dudley Peninsula.

*Goodenia varia. Sea cliffs of D'Estrees Bay.

*Goodenia geniculata. Sandy heath-ground by Cygnet River, at White Lagoon and Mount Pleasant.

var. *eriophylla.* Wet heath between American River and D'Estrees Bay.

*Selliera radicans. Cygnet River, Murray Lagoon, Eleanor and Stun'sail-boom Rivers.

*Scævola crassifolia. Coast hills, Pennington Bay and eastward, and at Vivonne Bay.

*Scævola æmula. About Mount Pleasant and towards Mount

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Mary; profusely abundant over area of burnt heath, Central Dudley Peninsula.

Scævola linearis. Kang. I., *Waterhouse*. Wet sandy heath-ground between American River and D'Estrees Bay.

*Dampiera lanceolata. Near D'Estrees Bay with the last; sandy ground by the sea near Rocky Point, Dudley Peninsula.

GENTIANEÆ.

Sebæa ovata. Kang. I., *Heuzenroeder*. Banks of the Eleanor River; pasture slopes by the sea, D'Estrees Bay; everywhere throughout Dudley Peninsula.

*Erythræa australis. On clay soils, Kingscote to the Freestone Hill Range; by the Cygnet and Eleanor Rivers; natural pastures throughout Dudley Peninsula. Specimens with white flowers are abundant in the mallee-scrub on stony ground between Rocky Point and Salt Lagoon, Dudley Peninsula.

LOGANIACEÆ.

*Mitrasacme paradoxa. Mossy banks in shaded gullies, and wet sandy heath-ground, Dudley Peninsula.

*Logania crassifolia. Sea cliffs, D'Estrees Bay.

Logania ovata. Kang. I., *Waterhouse*. Heathy ground, American River, White Lagoon, and Mount Pleasant to Karatta. Between Rocky Point and Salt Lagoon, Dudley Peninsula.

PLANTAGINEÆ.

Plantago varia. Kang. I., *R. Brown* (as P. parviflora), *Waterhouse*. Discovery Flat, Cygnet River, Eleanor River. Common grassy slopes of sea cliffs and natural pastures throughout Dudley Peninsula.

PRIMULACEÆ.

*Samolus repens. Cygnet River, Bay of Shoals and contiguous lagoons, Murray's Lagoon, and Eleanor River. Shores of Salt Lagoon, sea cliffs at Hog Bay River, Dudley Peninsula.

APOCYNEÆ.

*Alyxia buxifolia. Sea cliffs, Bay of Shoals, Kingscote, Western Cove, and American River.

CONVOLVULACEÆ.

Convolvulus erubescens. Kang. I., *Baudin's Exped.* Emu Creek, Discovery Flat, and Cygnet River. Natural pastures, North Dudley Peninsula.

*Dichondra repens. Thickets and shady places throughout Dudley Peninsula. Freestone Hill Range, Kingscote, American River, and Eleanor River.

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*Wilsonia rotundifolia. Bay of Shoals and Salt Lagoon, Murray's Lagoon.
*Wilsonia humilis. Salt Lagoon by Pelican Lagoon.
*Wilsonia Backhousii. Margin of Salt Lagoon by Flour-cask Bay.

SOLANEÆ.

Solanum nigrum. Kang. I., *Waterhouse*. Growing among mica-slate rocks on the upland country about American Beach.
Solanum simile. Kang. I., *R. Brown*. Towards Kangaroo Head and Hog Bay River. Kingscote, American River, and River Eleanor.
Nicotiana suaveolens. By the sea shore, *Leschenault*. Rocks by the sea, north and north-west coasts of Dudley Peninsula; gorge of the Hog Bay River.
*Anthocercis myosotidea. Wet sandy heath between American River and D'Estrees Bay.

SCROPHULARINEÆ.

*Mimulus repens. Wet banks of Hog Bay, Cygnet and Eleanor Rivers.
Gratiola Peruviana. Kang. I., *Waterhouse*. Cynet and Stun'-sail-boom Rivers.
Limosella aquatica. Kang. I., *R. Brown*.
*Veronica distans. Sand-dunes and calciferous sand-rock, Hog Bay River, Rocky Point, American River and Mount Mary.
Veronica calycina. Kang. I., *Waterhouse*.
*Euphrasia Brownii. Sea cliffs, D'Estrees Bay.

LENTIBULARINÆ.

*Polypompholyx tenella. Margin of runnels on heathy ground, Central Dudley Peninsula.

ASPERIFOLIACEÆ.

*Myosotis australis. Shady gullies and thickets throughout Dudley Peninsula.

LABIATÆ.

Scutellaria humilis. Kang. I., *R. Brown*, *Sealey*. Thickets, on the sand-dunes at Hog Bay and American Beach, at Hog Bay River and Mopehawk Gully.
Prostanthera spinosa. Scrub near Wallan's Hut and Cygnet Bay, *Waterhouse* in Frag. Phyt., vi., 108. Bushy places, Cygnet and Stun'sail-boom Rivers, &c.; heath-ground from Mount Pleasant to Karatta.
Prostanthera coccinea. Sandy-scrub, *Waterhouse*. Common about Kingscote and American River; stony ridge near Rocky Point, Dudley Peninsula.
Prostanthera chlorantha. Cygnet Bay, *Waterhouse*.

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*Westringia rigida. Dudley Peninsula, *T. Willson!*

Ajuga australis. Kang. I., *Waterhouse.* Cygnet River; under gum trees, Hog Bay River.

MYOPORINEÆ.

*Myoporum insulare. By the coast around Dudley Peninsula, Nepean Bay, &c.

Myoporum viscosum. Kang. I., *Frag. Phyt.*, vii., 110. Kingscote, American River, Cygnet, Eleanor and Stun'sail-boom Rivers; sand-dunes at Mount Mary; common in the mallee-scrub, Dudley Peninsula, flowering while still young, when not attained one foot in height.

*Myoporum parvifolium. Hawk's Nest.

Eremophila Behriana. Kang. I., *Waterhouse.* Wet heath, near D'Estrees Bay.

Eremophila Brownii. Kang. I., *Waterhouse.* Heath and coast plains, common; rare in mallee scrub on the north coast of Dudley Peninsula.

EPACRIDEÆ.

Styphelia humifusa. Kang. I., in *Fl. Austral.* Heaths, common; sandhills at Mount Mary.

Styphelia Sonderi. Kang. I., in *Fl. Austral.* Heathy grounds at American River, Mount Pleasant, Eleanor River and Central Dudley Peninsula.

*Styphelia strigosa. Mount Pleasant.

Styphelia Richei. Kang. I., in *Fl. Austral.* Sand-dunes, Nepean Bay, American River, Vivonne Bay and American Beach.

*Styphelia concurva. Stony heath-ground, Harriet River and American River; stringybark scrub, near Birchmore Lagoon.

Styphelia rufa. Kang. I., *Sealey, Waterhouse.* Sandy heath-ground, near American River, Birchmore Lagoon to Mount Pleasant and Karatta; Central Dudley Peninsula.

*Styphelia striata. Heaths about American River, and from Mount Pleasant to Karatta.

Styphelia patula. Kang. I., in *Fl. Austral.* Western Cove, and stony ridge, south of Rocky Point, Dudley Peninsula.

Styphelia depressa. Kang. I., *R. Brown.* Widely dispersed, Dudley Peninsula; Kingscote, White Lagoon, &c.

*Styphelia ovalifolia. Sand-dunes, Vivonne Bay.

Brachyloma ericoides. Kang. I., in *Fl. Austral.* Sandy heath-ground between American River and D'Estrees Bay.

CONIFERÆ.

Callitris verrucosa. Kang. I., *R. Brown.* On sandy ground near the coast, Hog Bay River to American Beach and American River; Western Cove and Bay of Shoals.

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*Callitris cupressiformis. Thicket, about four miles from Cygnet River, towards Birchmore Lagoon.

ORCHIDEÆ.

*Thelymitra longifolia. Thickets, Mopehawk Gully, &c., North Dudley Peninsula.

*Diuris longifolia. North Dudley Peninsula, *T. Willson!*

*Microtis porrifolia. Natural pastures and open thickets throughout Dudley Peninsula; Cygnet River.

*Pterostylis præcox. Bay of Shoals and Dudley Peninsula, *R. S. Rogers!*

*Pterostylis nana. Heath between Hog Bay and Hog Bay River.

*Cyrtostylis reniformis. Bay of Shoals, *R. S. Rogers!* Glades on edge of mallee-scrub, Mopehawk Gully, and under ti-tree scrub by Salt Lagoon, Dudley Peninsula.

Caladenia carnea. Kang. I., *Waterhouse.*

*Caladenia deformis. North Dudley Peninsula, *T. Willson!*; heath, Central Dudley Peninsula.

IRIDEÆ.

*Patersonia glauca. Wet sandy heath at White Lagoon, and at three miles east from Karatta.

Sisyrinchium cyaneum. Kang. I., *R. Brown.* Widely distributed through Dudley Peninsula. Grass-lands and clay-flats, common on the north coast, but extending to Karatta; occasionally on loose sand as at Mount Mary and American Beach.

HYDROCHARIDEÆ.

*Halophila ovata. Bay of Shoals and Nepean Bay.

*Ottelia ovalifolia. Cygnet River.

LILIACEÆ.

*Dianella lævis. Cygnet River, Western Cove, towards D'Estrees Bay, and at Karatta. Open parts of mallee scrub and thickets, sparsely distributed, over Dudley Peninsula.

*Burchardia umbellata. Heath near D'Estrees Bay and Central Dudley Peninsula; heathy scrub, Hog Bay River.

Thysanotus dichotomus. Kang. I., in *Frag. Phyt.*, vii., 69. Heath-ground towards D'Estrees Bay, at White Lagoon, and Mount Pleasant.

*Thysanotus Patersoni. Thickets and heath-ground throughout North and West Dudley Peninsula.

*Chamæscilla corymbosa. Sandy heath-ground about sources of Hog Bay River.

Bulbine semibarbata. Kang. I., *R. Brown.* The commonest plant on Dudley Peninsula. Clayey ground, Kingscote to Freestone Range, to American River and Mount Pleasant.

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*Arthropodium strictum. Gullies and cliffs by the sea, north-west parts of Dudley Peninsula; gorge of the Hog Bay River.

*Arthropodium laxum. On the metamorphic rocks of Kingscote Point.

*Xanthorrhœa quadrangulata. Heath-ground from south side of Cygnet River to D'Estrees Bay and the Stun'sail-boom River; Central Dudley Peninsula.

FLUVIALES.

*Triglochin centrocarpa. Mossy banks in gullies and cliff slopes by the sea, North-west Dudley Peninsula.

*Triglochin striata. Margins of the Cygnet, Eleanor, Stun'sail-boom and Hog Bay Rivers.

Triglochin mucronata. Kang. I., in *Fl. Austral.*

*Triglochin procera. Cygnet, Eleanor and Stun'sail-boom Rivers.

*Potamogeton natans. Lagoon-like extensions of the Lower Cygnet River; in the Stun'sail-boom River.

*Potamogeton obtusifolius. Cygnet River.

*Potamogeton pectinatus. Cygnet and Eleanor Rivers.

*Ruppia maritima. Cygnet, Eleanor and Hog Bay Rivers, Deep Creek.

JUNCACEÆ.

*Luzula campestris. Natural pastures and glades in thickets throughout Dudley Peninsula.

*Juncus bufonius. American River. Margins of streams, clay-flats, and wet ground, Dudley Peninsula.

*Juncus pauciflorus. Thickets bordering the Harriet and Stun'sail-boom Rivers.

*Juncus pallidus. Common by margins of rivers and inundated flats throughout the island.

RESTIACEÆ.

*Trithuria submersa. By runnels, heath-ground Central Dudley Peninsula.

*Aphelia gracilis. With the last.

*Aphelia Pumilio. Mossy banks in gullies, and cliffs by the sea, North Dudley Peninsula.

*Centrolepis polygna. With the last.

*Centrolepis strigosa. With the last, and at American River.

*Centrolepis aristata. By runnels, heath-ground Central Dudley Peninsula. *Var. pygmæa.* Sea-slopes, south of Kangaroo Head.

*Calastrophus fastigiatus. Wet sandy heath-ground between American River and D'Estrees Bay, White Lagoon and near Karatta.

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CYPERACEÆ.

*Heleocharis sphacelata. Cygnet, Harriet and Stun'sail-boom Rivers.
*Heleocharis multicaulis. Stun'sail-boom River.
*Heleocharis acuta. Cygnet River at the "sheep-wash."
*Scirpus fluitans. Cygnet, Stun'sail-boom and Hog Bay Rivers.
*Scirpus riparius. Hog Bay and Eleanor Rivers; soakage at Frenchman's Rock, Hog Bay, and heath-ground central Dudley Peninsula.
*Scirpus cartilagineus. Damp gullies and cliff-slopes by the sea, north Dudley Peninsula; American River.
*Scirpus inundatus. Cygnet and Stun'sail-boom Rivers.
*Scirpus nodosus. Depressed parts of sandhills, Nepean Bay, American River, Vivonne Bay, American Beach and Hog Bay River.
*Scirpus setaceus. Heath-ground, Central Dudley Peninsula.
*Chorizandra enodis. Inundated ground Discovery Flat, Birchmore's Lagoon and White Lagoon.
*Schœnus nitens. Eleanor and Stun'sail-boom Rivers.
*Schœnus Tepperi. Heath near D'Estrees Bay; White Lagoon and frequent on open heath-ground to beyond the Eleanor River.
*Schœnus apogon. Heath-ground Central Dudley Peninsula.
*Schœnus sculptus. By runnels, heath-ground central Dudley Peninsula.
*Schœnus, sp. With the last.
*Lepidosperma gladiatum. Sand-dunes between Hog Bay River and False Cape.
*Lepidosperma viscidum. Around inundated ground, throughout main mass of the island; heath, Central Dudley Peninsula.
*Lepidosperma filiforme. Sandy heathy ground, common; Central Dudley Peninsula.
*Cladium junceum. Wet heathy ground between the Eleanor and Stun'sail-boom Rivers.
*Cladium Filum. Inundated ground, White Lagoon, Hawk's Nest, Mount Pleasant and near Karatta.
*Cladium deustum. Coast-cliffs between Pennington Bay and Hog Bay River; stony ground between Mount Pleasant and Eleanor River.
*Caustis pentandra. Wet heath between American River and D'Estrees Bay, near White Lagoon and Karatta.
*Carex tereticaulis. Stun'sail-boom River.
*Carex pseudo-cyperus. With the last.

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GRAMINEÆ.

*Spinifex hirsutus. Sandy sea-shores, Bay of Shoals, Nepean Bay, D'Estrees Bay, &c.; American Beach.

*Lepturus incurvatus. Salt Lagoon and at Kingscote; along the margins of the salt-water creeks, north Dudley Peninsula.

*Erhharta stipoides. Banks of Cygnet River; shady places throughout Dudley Peninsula.

*Stipa teretifolia. Rocks by the sea, north coast of Dudley Peninsula.

*Stipa semibarbata. Wet heath between American River and D'Estrees Bay.

*Stipa aristiglumis. American River and Discovery Flat. Open grassy lands throughout Dudley Peninsula.

*Dichelachne crinita. Open places in mallee scrub, north Dudley Peninsula; sandy ground, Rocky Point; Hog Bay River.

*Dichelachne sciurea. Heath near American River, and throughout Dudley Peninsula.

*Echinopogon ovatus. Thickets, on the Cygnet River; under shade of gum-trees, Hog Bay River.

*Sporobolus Virginicus. Wet subsaline places, Cygnet and Eleanor Rivers; north and north-west coasts of Dudley Peninsula and Hog Bay River.

*Agrostis Solanderi. Inundated ground, towards the Freestone Range, Nepean Bay and American River; shady places on the Cygnet River. Natural pastures throughout Dudley Peninsula; also heath-ground.

*Agrostis quadriseta. Shaded banks of the Cygnet and Stun'-sail-boom Rivers.

*Danthonia penicillata. Shady places, American River, Eleanor and Cygnet Rivers. Natural pastures throughout Dudley Peninsula; also heath-ground.

*Danthonia nervosa. Shady places, Cygnet and American Rivers.

*Poa cæspitosa. Sea-cliffs along south coast; subsaline tracts, Bay of Shoals; natural pastures throughout Dudley Peninsula.

*Festuca bromoides. Natural pastures, Freestone Hill Range and throughout Dudley Peninsula.

*Festuca litoralis. Sand-dunes, Hog Bay River.

Distichlis maritima. Kang. I., *Heuzenroeder*. Littoral and subsaline tracts, Bay of Shoals, Nepean Bay, and north coast of Dudley Peninsula.

*Bromus arenarius. Sand-dunes, Hog Bay and American Beach.

*Agropyron scabrum. Towards Freestone Hill, American

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River, and common in thickets throughout Dudley Peninsula.

FILICES.

Adiantum Aethiopicum. Kang. I., *R. Brown.* Thickets on the Stun'sail-boom River.

*Cheilanthes tenuifolia. On metamorphic rocks, American River, North Dudley Peninsula, Deep Creek and Hog Bay River.

Pteris aquilina. Kang. I., *Waterhouse.* At the Wells, Western Cove; American River; by the Harriet and Stun'sail-boom Rivers.

*Lomaria discolor. Thickets in the bed of the Stun'sail-boom River.

*Lomaria capensis. With the last.

*Grammitis leptophylla. Deep Creek and gullies on the north-west coast of Dudley Peninsula.

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MISCELLANEOUS CONTRIBUTIONS TO THE NATURAL HISTORY OF SOUTH AUSTRALIA.

Edited by Professor R. TATE, Director of the Natural Science Correspondence Department.

ZOOLOGY.

NOTE ON THE OCCURRENCE OF PSALIDURA IN SOUTH AUSTRALIA.

The weevil, remarkable by its having a pair of anal forceps, which was exhibited at the May meeting, belongs to the genus *Psalidura*, so the Rev. T. Blackburn informs me. The genus *Psalidura*, MacLeay, is comprised in the Family Amycteridæ, of the order Curculionidæ, "the most remarkable feature of which," writes W. MacLeay, jun., Tran. Entom. Soc., N.S.W., I., p. 201, "is the strong anal forceps with which the male is armed . . and seems to enclose the organs of generation . . The large excavation of the last ventral segment in the male is remarkable; but this is also characteristic of the allied genus *Talaurinus*. . . Very little is known of the habits of these insects."

Thirty-six species of *Psalidura* inhabit Australia, but are most numerous in New South Wales and Queensland. This is the first record of the occurrence of the genus in South Australia, represented by a species allied to *P. elongata*, MacLeay, jun.

Locality.—Fowler's Bay, *Mrs. A. Richards*, one example; Mount Parry, Aroona Range, *R. Tate*, two examples.

Ralph Tate.

NOTES ON SOUTH AUSTRALIAN COLEOPTERS DESTRUCTIVE TO VEGETATION.

"DIPHUCEPHALA SPLENDENS, *W. S. Macleay, v. D. colaspidoides, Gyllenhal.*—"I do not know which name has the priority. It is a leaf-eater, and when very numerous (as it sometimes is) is injurious to some plants. I have seldom seen it in New South Wales, but is the most common in Victoria."—*Hon. W. Macleay.*

"During November, 1882, it occurred in myriads about Mount Gambier, by Glencoe, to Mount Graham, attacking elms, and vines, apricots, and other fruit trees; also

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some indigenous shrubs and trees, particularly *Acacia decurrens*, extensive groves of which I had seen absolutely denuded of leaf. Two years before it committed serious depredations about Mount Graham. *D. splendens* has not hitherto been recorded for South Australia, and appears to reach its western limit in the South-East of this colony."—*R. Tate.*

"This little pest is a perfect terror to the fruit-growers in this colony, and is seen in countless thousands. I have seen them covering every living part of Leptospermum bushes for miles in extent. When they alight they make short work of all green leaves, cherries and plums being specially singled out for their attention. In our colony the means generally adopted for its extirpation are to light fires near where they are thickest, and I am pretty certain that the larvæ feed on the roots of *Leptospermum scoparium* or *L. lævigatum*. Here these insects make their appearance about every three years."—Extract from letter by Charles French, Botanic Gardens, Melbourne.

"Sphœropterus sp. comes very close to the genus *Otiorhynchus* of Europe, and will, I think, fit in to the genus Sphœropterus of Guerin, which represents *Otiorhynchus* in this part of the world; but the species is quite new to me."—*W. Macleay.*

"This weevil was taken in December upon and beneath orange trees in the garden of Mr. G. Laughton, Walkerville, where it had made sad havoc among the trees named and others. It seems to be a different species from the one infesting the almond."—*R. Tate.*

"Lamprima varians, *Burmeister;* like all of the genus, it is a leaf-eater, but I never before heard of its being destructive."—*W. Macleay.*

"The specimens upon which the above determination was founded were sent by Mr. Love, Forester, Wirrabara Forest Reserve, with the note that it had caused some damage to the young forest growth during the summer of 1882."—*R. Tate.*

List of Marine Mollusca, Rottnest, Freemantle.

Named by Professor R. Tate.

A small parcel of shell-sand forwarded by M. A. H. Courderot de Malange has furnished, as far as the condition of the specimens will admit of satisfactory identification, the following species, which are for the most part known only in South Australian waters:—

Clathurella rufozonata, *Angas.*
Clathurella bicolor, *Angas.*
Marginella sagittata, *Hinds.*
Marginella albida, *Tate.*
Bittium tenue, *Sow.*

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Rissoina elegantula, *Angas.*
Rissoina crassa, *Angas.*
Cingula spina, *Crosse.*
Turbonilla acicularis, *Adams.*
Parthenia gracilis, *Angas.*
Oscilla ligata, *Angas.*
Leiostraca acutissima, *Angas.*
Triforis Angasi, *Crosse.*
Cerithiopsis croccea, *Angas.*

BOTANY.

Bibliographical Notes Refuting the Alleged Alien Nature of Two Species of South Australian Plants.

1. Orobanche cernua, *Bentham (non Loefl.)*—In the pages of our Transactions, vol. iv., p. 135, 1881, I have given my reasons for the opinion that the only Australian species of the genus is indigenous, and probably distinct from the European plant with which it had been conjoined. Baron Sir F. von Mueller, in his recently published "Systematic Census of Australian Plants," has given the Australian plant specific rank under the name of *Orobanche australiana.* Lately, I have had an opportunity of reading James Backhouse's "Narrative of a Visit to the Australian Colonies," and therein, at p. 511, I find recorded the occurrence of "an *Orobanche* very like *O. minor* of England" on sandy ground covered by cypresses near Port Adelaide. I have gathered *O. australiana* at the same station; the two plants are evidently conspecific; and as Backhouse's observations were made November 30 and December 12, 1837, so soon after the settlement of the colony no room for doubt is left as to its endemic origin. In September of this year I found it in the dry bed of Mount Parry Creek, Aroona Range, where it is parasitic on the roots of Ixolæna tomentosa.

2. Verbena officinalis, *Linn.*—By some this is considered an alien; but as Backhouse noted it in 1837 along the borders of the River Torrens, its claim to rank as an endemic species is thereby satisfactorily established. In the "Flora Australiensis," it is recorded as occurring "near Adelaide, *Blandowski;* and towards Spencer's Gulf, *Warburton.*" To these localities I can add banks of the Little Para River near Salisbury, banks of the River Murray about Morgan, Lake Alexandrina at Point Pomond, gullies to the east of Belair and around the Springs near Mount Graham. *R. Tate.*

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Notes on Microstemma tuberosum, *R. Brown.*

This plant belongs to the order Asclepiadeæ, and was originally described by Robert Brown from specimens collected by him on islands in the Gulf of Carpentaria; a half-century later Baron Mueller found it on the Burdekin. The specific name is in allusion to its tuberose underground stems; the tuber, not much unlike a potato, is circular in outline, depressed, two or three inches in diameter. These characters are drawn from specimens received from Inspector Foelsche, who obtained them near Palmerston. Under Mr. Mohan's care, a tuber planted November 30, 1882, developed a slender simple branch one-and-a-half foot high, with distant linear leaves, terminating in a short raceme of dark-coloured inconspicuous flowers, which appeared towards the middle of February.

Inspector Foelsche writes:—"By the aid of the natives I have found a bulb plant . . . the bulb of which is eaten by them, and I have eaten it myself. It resembles very much a white turnip, and when boiled does not taste unlike it; the natives eat them raw or roasted. The plant grows plentifully at Palmerston and neighbourhood." *R. Tate.*

Note on the presence of "Tannin" in the "Polygonum" of Explorers. By Professor R. Tate.

Being aware that tannin exists in many plants of the Order Polygonaceæ, I turned my attention to the "Polygonum-bush" of explorers, botanically known as *Muehlenbeckia Cunninghamii*, as a probable economic source of that valuable substance. The results of two experiments on the dried twigs gave a mean of only 3·038 per cent. of tannin, a ratio far too low to render the plant commercially valuable.

BIBLIOGRAPHICAL NOTICES.

Synonymy of Australian Marine Mollusca. By J. Brazier, Proc. Lin. Soc., N.S.W., viii., pp. 224-234.

Among others, references are made to the following South Australian species:—

Natica Baconi, Angas=*N. Incei*, Philipi.
Cancellaria undulata, Angas=*N. granosa.*
Lucina Cumingi, Ad. and Angas=*L. dentata*, Wood sp.
Modiolaria barbata.

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NEW GENERA AND SPECIES OF AUSTRALIAN FISHES. By C. W. DeVis, Pro. Linn. Soc., N.S.W., viii., p. 283.

The following species are founded on South Australian samples:—

Dactylophora (n. gen. of fam. Cirrhitidæ) *semimaculata* and *Platycephalus semermis*.

DESCRIPTION OF A NEW HONEY-ANT. By Sir John Lubbock, Proc. Linn. Soc., London, vol. xvii., p. 51, April 17, 1883 (Pl. ii., figs. 1-10).

Melophorus (n. gen.) *Bagoti*, from Central Australia.

REMARKS ON THE "MANNA" OR LERP INSECT OF SOUTH AUSTRALIA. By J. G. Otto Tepper, Proc. Linn. Soc., London, vol. xvii. p. 109, July 31, 1883.

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ABSTRACT OF PROCEEDINGS

OF THE

Royal Society of South Australia,

FOR 1882-83.

ORDINARY MEETING, NOVEMBER 7, 1882.

CHARLES TODD, C.M.G., President, in the chair.

BALLOT.—Messrs. John B. Whiting and A. B. Black were elected Fellows.

EXHIBITS.—Professor TATE, F.G.S., exhibited *Trymalium Wayii* (F. von Mueller and Tate) and *Hymenanthera Banksii* from the Onkaparinga Gorge; also *Dendrobium Foelschei* (F.v.M.), a new epiphytal orchid found by Mr. Paul Foelsche at Port Darwin; also a piece of hydrated silicious rock containing Miocene fossils, found at Tintara vineyard, near Noarlunga, at an elevation of 525 feet above sea level; also a collection of seaweeds made by Mr. M. de Courdorot at Rottnest Island; and a collection of Alpine plants from the sources of the Mitta Mitta, by James Stirling, Omeo, Victoria.

Mr. FRAZER S. CRAWFORD moved—"That the Council of the Society be requested to arrange for the opening of the room at stated intervals for holding informal meetings."

His Honor the CHIEF JUSTICE moved as an amendment—"That the proposal be referred to the Council for their recommendation on the subject."

The amendment was carried.

J. DAVIES THOMAS, M.D., F.R.C.S., Eng., read a paper upon "Statistics of Hydatid Disease in Australia."

ORDINARY MEETING, DECEMBER 5, 1882.

H. WHITTELL, M.D., in the chair.

BALLOT.—The Hon. Allan Campbell, M.L.C., &c.; E. B. Grundy; and J. E. Brown, F.L.S., were elected Fellows.

The Council's recommendation that, during nine months of the year, the evening of the third Tuesday of each month

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should be set apart for informal meetings of members, was adopted.

It was resolved that the Council be requested to present Mr. Walter Rutt, C.E., with a life membership, in recognition of his services as Hon. Sec. during five years.

A discussion on Dr. Davies Thomas' paper upon "Hydatids" then followed.

ORDINARY MEETING, FEBRUARY 6, 1883.

C. TODD, Esq., C.M.G., in the chair.

BALLOT.—Prof. H. Lamb, Thomas Parker, C.E., and John Haslam, C.E., were elected Fellows.

EXHIBITS.—The Rev. W. R. Fletcher, M.A., exhibited some iron concretions found by him amongst the Bald Hills, S.A. Prof. Tate, F.G.S., exhibited specimens of three species of S. A. Coleopters destructive to vegetation.

The following letter by Mr. Samuel Dixon was read:—

In view of the discussion taking place on Hydatids, I wish to mention some facts which I have observed.

Some years ago, before fencing in runs had begun and all sheep were shepherded, it was no uncommon thing for as much as 2 per cent. of the hoggetts, or year-old sheep, to die from "crankiness" or "tumsick."

The symptoms were dulness, ceasing to feed, or to follow the flock, and then sudden paroxysms of turning rapidly round and round, until the unfortunate fell, or else, after standing motionless for a long time, a sudden rush straight ahead, as if blind, would by followed by another fall, and in time the poor brute would become too emaciated to feed, and die, unless killed by dogs, of pure starvation.

On dissecting the head, a cyst would be found occupying almost the whole of the right or left lobe of the brain, and on the opposite side to that to which the sheep turned, or in other cases where the sheep would stand stock still, nearly the whole of the cerebellum would be replaced by a cyst.

After the sheep reached two years, fewer died, and old sheep were almost free from it.

Now-a-days a "cranky" sheep is seldom to be seen anywhere, and the reason is not far too seek. At the time I speak of it was customary to have two shepherds and a hutkeeper at each hut, and as each man had his dogs, it was not uncommon to see a dozen at one hut—(this was before the Dog Act). The shepherds, especially the laziest ones, were accustomed to keep the flocks round about the huts, especially in the evening after watering, when sheep eat the greediest, and I have no doubt this partially accounts for the heavy losses amongst young sheep. The old sheep being more cautious, the stink from grass soiled by dogs would prevent them eating it.

Is it not most important to discover what length of exposure to solar heat will destrov the hydatid germ, seeing that our water supply in Adelaide is derived from a catchment area covered with villages and farmhouses, and in the Northern Areas the household supply of water is frequently from dams filled from the hardened surface immediately surrounding farmhouses where dogs have fouled the surface?

I have never heard of these cysts being found in cattle.

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DISCUSSION.

Dr. WHITTELL thought from the description of symptoms given by Mr. Dixon that the disease was not caused by hydatids but by a species of *Cœnurus* in its larval condition, and this did not affect man.

Dr. GARDNER was also of opinion that the disease in the sheep was caused by *Cœnurus cerebralis*. As this parasite was derived as well from the ova of a tape-worm of a dog (*Tænia cœnurus*) the fact of the disease being less prevalent when the sheep were paddocked than when they were shepherded, was as easily explainable as though the *Tænia* had been *Tænia echinococcus*. Furthermore, the brain was a rare locality for the "hydatid," but a favourite one for the *Cœnurus*.

Prof. TATE suggested that if hydatids were existent in the brain of a sheep the symptoms would be similar.

Mr. DIXON said that the cysts observed by him agreed with the descriptions given by medical authorities.

ORDINARY MEETING, MARCH 6, 1883.

C. TODD, C.M.G., &c., President, in the chair.

BALLOT.—C. Bowyer-Smythe, H. Gill, Rev. W. Howchin, and H. Y. L. Browne were elected Fellows.

EXHIBITS.—Professor Tate, F.G.S., &c., exhibited a dead specimen of the mollusc (*Argonauta tuberculosa*), popularly known as the "paper-nautilus," forwarded by Mrs. Richards from Flinders Island. Also the tuber of *Microstemma tuberosum* sent by Inspector Foelsche, Corresponding Member, from Palmerston. Also a new species of Compositæ, *Epaltes Tatei*.

Dr. DAVIES THOMAS read some further observations on hydatids.

Prof. TATE read a "Record of new plants and of new Localities for Rare Plants," by himself.

Mr. J. G. O. TEPPER, F.L.S., sent some "Botanical Notes."

Mr. D. B. ADAMSON read a paper upon some experiments made by him upon Carre's di-electric induction machine, and performed some experiments.

CHARLES TODD, C.M.G., &c., announced that he had been very successful in taking observations of the transit of Venus, when at Wentworth.

Prof. TATE, F.G.S., &c., mentioned that the rules of the Society did not provide for the loan of books out of the library, and on behalf of the Council requested permission to make by-laws for regulating such loans. This was granted.

Prof. TATE, F.G.S., &c., &c., read some "Notes upon *Geo-*

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psittacus occidentalis," sent by Mr. F. W. Andrews. He supplemented the same with some bibliographical notes, and Dr. Stirling exhibited a stuffed specimen.

A list of Algæ collected at Hallett's Cove, St. Vincent Gulf, by Mr. J. G. O. Tepper, F.L.S., Corresponding Member, and identified by Prof. J. Argadh, was laid on the table.

C. Todd, C.M.G., drew attention to the fact that the difference of longitude between Singapore, Banjoewangie, Adelaide and Melbourne had been satisfactorily determined.

Ordinary Meeting, April 3, 1883.

C. Todd, C.M.G. (President), in the chair.

Ballot.—F. S. C. Driffield, Herbert Hughes, jun., and John Henry Mohan were elected Fellows.

Exhibits.—Prof. Tate, F.G.S., &c., showed some cakes of mud upon which the wings of termites had become impressed very perfectly, showing the nervules distinctly. He suggested that in undisturbed localities these impressions might be covered with another thin layer of mud, and in course of time the impressions would become fossilised.

The President submitted a code of rules for regulating the loan of books from the library to the Fellows and Members of the Society, and requested confirmation of the same by the Fellows present. This was done, and it was decided to put the rules into practice, subject to the decision of the annual meeting.

The President announced that His Excellency the Governor had accepted the office of Vice-Patron of the Society.

The President said it was a pleasant circumstance that Lieut. Darwin, son of the late Charles Darwin, the great naturalist, had been deputed by the Royal Society in London to come to the Colonies and take observations of the transit of Venus, in which, however, through the state of the weather, he had not been very successful. Lieut. Darwin was also engaged, in conjunction with himself, in determining the longitudes.

Prof. Tate, F.G.S., &c., read a "Diagnosis of a New Species of Compositæ," by Baron von Mueller, and named by the latter *Achnophora Tatei*.

Prof. Tate, F.G.S., also read a paper on the "Proteaceæ of the Australian Alps," by James Stirling, F.L.S., of Omeo, Victoria.

H. Whittell, M.D., read a description of a "Dissection of a Compound Ascidian."

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Ordinary Meeting, May 1, 1883.

H. Whittell, M.D., Vice-President, in the chair.

Ballot.—James Stirling, F.L.S., was elected a Corresponding Member, and J. Nicholls and A. K. Varley were elected Fellows.

Exhibits.—W. Haacke, M.D., exhibited 22 embryos of the common ground shark (*Mustelus anarcticus*), including nine females and 22 males; also specimens of *Medusæ*, belonging to the new order *Psendorhizidæ*, lately founded by D. v. Lendenfeldt, these he thought to belong to a new genus. Also specimens of *Crustaceæ* were shown, taken from sacs in the skin of the Monocanthus or Leather-jacket. Also four embryos of a Skate. Also several specimens of *Cryptodromia littoralis* or sponge-back crabs. Dr. Haacke mentioned that in dredging he had taken a great number of these, some of which had simple and compound ascidians fixed upon their backs. Prof. Tate, F.G.S., exhibited a weevil belonging to the genus *Psalidura*, giving the idea of an entomological marsupial.

Dr. Haacke read a paper consisting of "Observations made on a female *Trachydosaurus rugosus*, and her young," by Miss Tomsett, contributed by Mr. Govett, of Port Adelaide Museum. Dr. Haacke exhibited living specimens of the same species and preserved specimens of *T. rugosus* and *T. asper*, together with some dissections of the same.

Prof. Tate, F.G.S., &c., read a description of a new species and genus of *Verbenaceæ* (*Tatea subacaulis*) from Arnheim's Land, diagnosed by Baron v. Mueller. He also directed attention to a work upon which the latter was engaged, viz., "A Systematic Census of Australian Plants." He also read "Additions to the Flora of Australia," mentioning that since Bentham's "Flora Australiensis" was published, upwards of 800 new plants had been described. He next read a "Diagnosis of three new Species of Squilla."

Dr. Haacke described his new apparatus for preserving natural history specimens in spirits.

J. G. O. Tepper, F.L.S., sent "Botanical Notes," which were read by Prof. Tate.

T. Meyrick, B.A., forwarded some remarks on the descriptions of supposed new *Lepidoptera*, as published in this Society's Transactions, which were read by Prof. Tate. In this paper the author deprecates the practice of describing insects at haphazard as presumably new, and says that "no naturalist is entitled to describe a species as new until he has carefully examined for himself the description of allied species by other authors, and satisfied himself that his species is, so far as he can judge, truly undescribed; and until, moreover, he has pro-

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perly examined the generic structure and attempted to indicate its true position in classification." According to the author, who had inspected original drawings of the species—*Smerinthus* (?) *Wayii*, Tepper, vol. v., p. 29, is a known species of *Geometrina*. *Lithosia rubrata*, id., p. 30, is also already described; it is not a true *Lithosia*, though belonging to the family. *Thryphæna* (?) *tineæformis*, Tepper, id., p. 31, is the very well-known *Mecyna polygonalis*, Hb., one of the *Botydæ* (*Pyralidina*), and is abundant throughout most of the world, including Europe, the whole of Australia and New Zealand. Moreover, he considers all the butterflies, vol. iv., pp. 25 *et seq.*, already named, and has no doubt that *Lycæna Phœbe*, Murray, which he collected at Adelaide and Port Lincoln, is one of the species included.

ORDINARY MEETING, JUNE 5, 1883.

CHARLES TODD, C.M.G., President, in the chair.

BALLOT.—W. H. Phillips and Geo. F. Giles were elected Fellows.

Prof. TATE, F.G.S., sent some "Notes upon the Occurrence of Psalidura in South Australia;" also a list of unrecorded plants from Eyre Peninsula, chiefly based upon a collection made by Mrs. A. Richards, Corresponding Member, during October, 1882.

Mr. J. G. O. TEPPER sent some "Botanical Notes" and a reply to some remarks made by Mr. Meyrick, and read at the previous meeting.

Mr. W. RUTT, C.E., mentioned an exceptional rainfall which had recently occurred at Hamley Bridge. A tank, 26 feet above ground, 21 feet square, with vertical sides, between the afternoons of May 5 and 7 collected water to the depth of 15 inches. The PRESIDENT said the rainfall for this district was six inches for the month.

Mr. J. G. O. TEPPER presented some suspected fossils found by Mr. East, of Riverton, near Mount Lock, at an altitude of 2,800 feet. They were discovered on the surface of the Mount in decomposed mica slate.

Mr. J. HASLAM, C.E., read a paper upon "Sanitary Drainage."

ORDINARY MEETING, JULY 3, 1883.

CHARLES TODD, C.M.G., President, in the chair.

BALLOT.—W. H. Cornish was elected a Fellow.

EXHIBITS.—Mr. F. S. Crawford showed specimens of a plant found by Mr. H. T. Gluyas, of Telowie, much infested with a species of fungus, which appeared in two distinct

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forms. In one form it produced black pustules on the stem, which corresponded to the character of *Uromyces*; and the other form, which attacked the leaves, appeared to be a *Trichobasis*, or rust. Mr. J. G. O. Tepper exhibited a species of *Gordius*, or hair-worm, found near Hahndorf.

The PRESIDENT stated that the Board of Governors had recommended a grant of £90 16s.

Mr. S. POLLITZER, C.E., read a paper on the "Hydraulic Survey of the River Murray."

ORDINARY MEETING, AUGUST 7, 1883.

C. TODD, C.M.G., President, in the chair.

BALLOT.—E. Mitchell Smith was elected a Fellow.

EXHIBITS.—Prof. Tate, F.G.S., showed specimens of the honey-ant (*Melophorus Bagoti*, Lubbock), forwarded by Mr. May, of Alice Springs. Mr. H. Yeates exhibited a Wilmshurst's duplex electrical machine made by himself.

Prof. TATE laid on the table a description and diagnosis of a new genus of Compositæ.

An abstract of a paper by Mr. A. K. Varley entitled, "A suggestion as to the origin of typhoid fever," was read.

Prof. TATE, F.G.S, read the first part of a paper on Kangaroo Island.

ORDINARY MEETING, SEPTEMBER 4, 1883.

H. T. WHITTELL, M.D., Vice-President, in the chair.

BALLOT.—B. Poulton, M.B., J. W. Leary, W. E. Pickels, F.R.M.S., H. P. Woodward, and Thos. Evans were elected Fellows, and D. Burchell an Associate.

EXHIBITS.—Mr. L. C. E. Gee showed a leaf, which formed the habitation of a spider existing in the Everard Ranges. Mr. W. E. Pickels, F.R.M.S., showed specimens of graphite found near Port Lincoln; also manganese-ore from the vicinity of Terowie.

Mr. L. C. E. Gee was appointed to audit the accounts.

The VICE-PRESIDENT read a draft of rules for the regulation of the proposed Natural History Section of the Royal Society of South Australia. Notice of motion was given that they would be brought forward at the next meeting for consideration and adoption.

Prof. TATE, F.G.S., sent the remainder of his paper on Kangaroo Island, which was read.

Mr. T. C. CLOUD, F.C.S., sent an abstract of a "Catalogue of Minerals found in South Australia," which was read.

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Annual Meeting, October 2, 1883.

Charles Todd, C.M.G., President, in the chair.

Messrs. J. Bruer and C. H. Harris were elected Fellows of the Society.

Professor Tate gave a verbal explanation on a number of geological specimens sent in by Messrs. Sabine and Lattorff, from places on the west side of Lake Torrens, and said he would report on them.

Mr. J. G. O. Tepper brought forward a list of algæ from St. Vincent's Gulf; also, reported that Mr. J. C. Chambers had collected *Mimulus prostratus*, R. Br., at a new locality—the Everard Range.

Rules for regulation of Library were adopted.

Field Naturalists' Section.

Professor Tate explained that a number of young men connected with certain Societies in the city had intimated a desire to prosecute the study of natural history under the countenance of the Royal Society, and as the Council approved of the idea they had drawn up the following regulations:—

1. This Section is established to promote the practical study of Natural History, by affording fuller opportunities and facilities in meeting and working together.

2. This Section shall consist of:—(*a*) members of the Society who shall have signed the rules of the Section, and (*b*) of other persons not being members of the Society who shall have been elected *subscribers* to the Section.

3. The members of the Section shall elect their own Committee of Management.

4. Subscribing members shall pay annually 5s. in advance. The year to terminate on the 31st October.

5. Subscribers to the Section shall have access to the Library of the Society, and shall be entitled to a copy of the "Miscellaneous Contributions to Natural History," and the "Annual Reports" published by the Society for the current year.

6. The Committee of Management shall furnish to the Hon. Sec. of the Royal Society an Annual Report of the proceedings of the Section in time for publication in the Royal Society's Annual Volume.

7. By application to the Council, grants of money may be made out of the general funds of the Society to the Section.

The President spoke in favour of the proposal, which was intended to encourage the young men—who might in the future become members of the Society—to take field excursions in the study of natural history.

The regulations were confirmed.

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Mr. W. E. Pickels suggested that in inaugurating this section of the Society a conversazione should be held in one of the rooms of the Town Hall, and that Professor Tate might elucidate to probable members the objects of the section.

The matter was, after discussion, referred to the Council.

ANNUAL REPORT.

The Hon. Secretary read the annual report as follows :—

The Council has again the pleasure of giving a favourable report of the past year's work, and of the general condition of the Society. The membership of the Society has increased during the year from 123 to 149. The increase is almost exclusively in the class of Fellows, namely, 27, there being the Corresponding Member and the Associate elected in addition. Death has removed three Fellows, viz., William Goss, M.D., F.R.C.S. Eng., who was present at the first meeting when the Society was founded, and was the last but one representative; and George Hamilton and R. G. Thomas, who had been members of the Society since 1868 and 1877 respectively. The Natural History exhibits have been numerous and interesting. In connection with this the Council, in carrying out a resolution passed at a general meeting, arranged for the holding of informal meetings on the third Tuesday of each month. It was hoped that this might induce the members to come forward with exhibits, to compare notes, or to seek for information on any particular matter that might interest them, which they could not so very well do at the more formal meeting. Up to the present time the attendance has been small, and has consisted of an enthusiastic few, whose example, it is to be hoped, may be increasingly followed as time goes on.

The subscriptions to the Darwin Memorial Fund from the members of the Royal Society amounted to £21 9s. The expenses for advertising, postages, bank-draft, &c., &c., came to £3 12s., leaving a balance of £17 17s.; which was duly forwarded, and the receipt of which was acknowledged January 16, 1883.

Another new departure contemplated is the formation of a section for the more especial study of Natural History in the field. The Council has drafted suitable rules to define its connection with the parent Society, and hopes that these will receive confirmation at the present annual meeting. To make the proposed section as popularly and publicly useful as possible, it is intended to allow persons not wishing to become members of the Royal Society to join the section only, and by a moderate subscription obtain certain collateral advantages. Arrangements have also been made for giving greater facilities for borrowing books from the library of the Society. For this purpose the Council has drawn up a set of rules to regulate the removal and return of books. These have been adopted at a general meeting, and now await the confirmation of this annual meeting. Among the additions presented to the library during the past year are some valuable illustrated works, such as the records of the "Norwegian North Atlantic Expedition," the "Bulletin of the Museum of Comparative Geology, Harvard."

Mr. Chapple, B.A., B.Sc., moved the adoption of the report, and suggested that the Darwin Fund and the list of papers read during the year should be added to the report. Mr. W. Rutt seconded, and the motion was carried.

The balance-sheet showed that the receipts for the year, with balance brought forward, amounted to £416 14s. 5d., while the

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expenditure had been about £150, leaving a deposit balance of £200 and a credit balance of £75 13s. 7d.

ELECTION OF OFFICERS.

The PRESIDENT stated that he felt compelled to refuse to act for another year. His official duties were so heavy that he felt he could not give that time to the Society's affairs which was expected of its chief officer. So much depended on the President that no one should hold that high position unless he could carry out the duties to the satisfaction of himself and advantage of the Society. He asked them to excuse his shortcomings. Although he had not given so much time to the duties of President, he had given a great deal of attention to the work of the Board of Governors of the Institute, which took up considerable time. Therefore, although he could cry "peccavi" with respect to the Presidency, he did not think he need do so as a member of the Board. He would feel grateful if he was relieved. The two previous Presidents had been elected for two years each, but he should rather feel it a kindness if a similar honour were not paid to him. He would take that opportunity of explaining why he was not prepared with an address; his defection was owing to the pressure of his official duties. He would, however, prepare a paper, and hoped that would be taken in place of an address.

The election of officers resulted as follows:—President, H. L. Whittell, Esq., M.D.; Vice-Presidents, Professor H. Lamb and E. C. Stirling, Esq., M.D.; Treasurer, Mr. T. D. Smeaton; Hon. Secretary, W. L. Cleland, Esq., M.B.; Council, Professor Tate, Messrs. C. Todd, C.M.G., W. Rutt, and D. B. Adamson.

Professor TATE gave notice of motion to increase the number of members of Council to six.

PAPERS.

Dr. STIRLING, in the absence of Mr. F. W. Andrews, read his notes on several rare birds found near the Square Waterhole, near Mount Compass, on the road to Mount Jagged.

Professor TATE gave outlines of five papers by himself and Baron von Mueller.

The HON. SECRETARY read a communication from Mr. Frazer S. Crawford, in which reference was made to a letter from Mr. Maskell, of New Zealand, who has made a special study of the Coccidæ, congratulating Mr. Crawford on having discovered the male of *Lecanium cycadis*, the common black turtle-scale of our orange trees. Hitherto the males obtained by Mr. Crawford have not been full-grown, and he awaits additional material to complete the diagnosis.

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THE TREASURER IN ACCOUNT WITH THE ROYAL SOCIETY OF SOUTH AUSTRALIA.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Balance, October, 1882	201	10	5	By Printing Reports	67	2	3
Subscriptions	113	18	6	Assistant Secretary, Salary	21	0	0
Sale of Transactions	5	19	6	" " Publishing Reports.. ..	2	2	0
Government Grant	90	16	0	Rent to South Australian Institute	12	0	0
Interest on Deposit Receipt	4	10	0	Binding, Donations, &c.	17	11	6
				Printing and Advertising	14	16	6
				Postages and Sundries	6	8	7
				Balance in Bank, less Outstanding Cheque ..	75	13	7
				Deposit Receipt	200	0	0
	£416	14	5		£416	14	5

Audited and found corret,
LIONEL C. E. GEE, Auditor.
1st October, 1883.

THOMAS D. SMEATON, Treasurer.

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DONATIONS TO THE LIBRARY

For the Year 1882-3.

I.—Transactions, Journals, and Reports.

Presented by the respective Societies, Editors, and Governments.

Baltimore—American Chemical Journal. Vol. V., No. 3.
Ballarat School of Mines—Annual Report of 1882.
——————— Science Lectures, first series, 1882.
Batavia—Natuarkundig Tijdschrift voor Nederlandsch-Indie, to vol. XLII., 1851-1882.
Belfast Natural History and Philosophical Society—Proceedings for the Session 1881-82.
Berlin—Königlich-preussiche Academie der Wissenchaften. Sitzungzberichte, XXXIX.-LIV., 1882, and I.-XXI., 1883.
Bordeaux—Société des Sciences Physiques et Naturelles. Memoires, Serie 2, Tome V., 1882.
Brussels—Musée Royal d'Histoire Naturelle de Belgique. Bulletins, Tome I., 1882.
Cambridge, U.S.A.—Museum of Comparative Anatomy. Annual Report of the Curator for 1881-82.
——————— Bulletin, Nos. 1-4.
——————— Vol. X., No. 6, Report on the results of the Dredging in the Caribbean Sea, 1878-79.
——————— Vol. XIX., Report on the Fishes.
——————— Vol. XX., Report on the Ophiuroideæ.
Geissen—Bericht der Oberheissischen Gesellschaft für Natur- und-Heilkunde, No. CXX., 1882.
Lausanne—Société Vaudoise des Sciences Naturelles. Bulletin, Sér. 2, Tome XVIII., No. 88, 1882.
London—Journal of the Royal Microscopical Society. Series 2, vol. II., parts 6 and 5; vol. III., parts 1-4, 1882-83.
Munich—Königlich-bayerische Akademie der Wissenchaften. Sitzungsberichte der Mathematisch-physikaleschen Classe, 1881, Heft IV., 1882, Hefte 1-4.
New South Wales—Proceedings of the Linnean Society. Vol. VII., part 3, 1882; vol. VIII., parts 1 and 2, 1883.

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———— Report of Trustees of Sydney Public Library for 1882.

New Zealand—Colonial Museum and Geological Survey Department—Reports of Geological Explorations during 1881, with maps and sections.

———— Catalogues of the New Zealand Diptera, Hymenoptera, with description of the species by Prof. W. Hutton, 1882.

———— Seventh Annual Report of the Museum and Laboratory, 1882.

Norwegian—North Atlantic Expedition, 1876-78. Part VI., Holothuridæ; VII., Annelidæ; VIII., Mollusca; IX., Chemistry, 1882.

———— Meteorology, Christiana, 1882.

———— Geodatische Arbeiten. Hefte 1-3, 1882.

———— Vandstand Observationen. Heft 1 (Christiana, 1882).

Philadelphia—Academy of Natural Sciences' Proceedings. Part I., 1883.

South Australia—Report of the Botanic Gardens at Adelaide for year 1882.

———— Meteorological Observations taken at the Adelaide Observatory during 1880-82.

Southern Science Record.—Vol. II., Nos. 9-12. Melbourne, 1882.

Tasmania—Numerous] papers laid before the Legislative Council.

Victoria—Transactions and Proceedings of the Royal Society. Vol. XIX.

——— Victorian Year-Book for 1881-82.

——— Fourth Annual Report in connection with Friendly Societies, with Statistics of Friendly Societies.

——— Census for year 1881.

——— Census of Ages of the People.

——— Census of Conjugal Condition of the People.

——— Census of Education.

——— Australian Statistics for 1881. Statistical Register—Part III., Population; Part IV., Vital Statistics; Part V., Interchange; Part VI., Law, Crime, &c.; Part VII., Accumulation; Part VIII, Production; Part IX., Religious, Moral, and Intellectual, 1883.

Vienna—Kaiserlich Königliche Geologische Reischsanstalt Verhandlungen, 1882, Nos. 8-11; 1883, Nos. 1-6.

——— Kaiserliche Akademie der Wissenschaften. Sitzungsberichte, Mathematisch-Naturwissenschaftliche Classe, Band. 1882, Band. Hefte 1., 3, and 8, 1883.

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——— Kaiserlich-Konigliche Zoologisch-botanische Gesellschaft. Verhandlungen. Band XXXII., 1882.

Wuzburg—Physicalisch-Medicenisch Gesellschaft. Sitzungberichte, 1882.

II.—Books and Pamphlets.

(Names of donors in italics).

Bailey, F. M.—Synopsis of the Queensland Flora. Brisbane, 1883.

——— A Classified Index of the Indigenous and Naturalised Plants of Queensland. Brisbane, 1883.

Lamb, Horace—On the Vibrations of a Spherical Shell. London, 1883.

——— The Basis of Statics. London, 1883.

——— On the Oscillation of a Viscous Spheroid. London, 1883.

——— On the Vibrations of an Elastic Sphere. London, 1883.

Mueller, Baron Sir F. von—Systematic Census of Australian Plants. Part I., Vasculares. Melbourne, 1883.

——— The Flora of Australia. A lecture delivered at the School of Mines, Ballarat, 1882.

Pollitzer, S.—A Study about the River Murray. Adelaide, 1883.

Stirling, James—On the Caves perforating Marble deposits, Limestone Creek. Melbourne, 1883.

Todd, Charles—Observations of the Transit of Venus, December 8-9, 1874, at Adelaide. Reprinted from Memoirs Roy. Astron. Soc., vol. XLVII. London.

Watts, H.—Foraminifera of Victoria. Melbourne, 1883.

Wesslar, O. E.—Free Trade and Protection. London, 1883.

III.—Map.

South Australia. Map showing existing and proposed Lines of Telegraph, 1882. By *Charles Todd, Esq., C.B., F.R.A.S.*

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LIST OF FELLOWS, MEMBERS, &c.,

November 6th, 1883.

Those marked (F) were present at the first meeting when the Society was founded. Those marked (L) are Life Fellows. Those marked with an asterisk have contributed papers.

		Date of Election.
HONORARY FELLOWS.		
Angas, Geo. French, F.L.S., C.M.Z.S.	Norland-square, London	1879
Barkley, Sir Henry, K.C.M.G., K.C.B.	.. .. ..	1857
Ellery, R. L. J., F.R.S.	Observatory, Melbourne ..	1876
*Garran, A., LL.D.	Sydney	1853
*Hull, H. M.	Hobart	1855
Jervois, H. E. Sir W. F. D., K.C.M.G., C.B., &c.	New Zealand	1878
Little, E.	.. .. ..	1855
Macleay, W., F.L.S.	Sydney	1878
*Mueller, Baron Ferd. von., K.C.M.G., F.R.S., &c.	Melbourne	1879
Russell, H. C., B.A., F.R.A.S. ..	Observatory, Sydney ..	1876
Warburton, Col. P. E., C.M.G. ..	Beaumont	1858
*Wilson, C. A.	Supreme Court	1853
*Woods, Rev. J. E. T., F.L.S., F.G.S., &c.	Sydney	1877
CORRESPONDING MEMBERS.		
*Andrews, F. W.	Adelaide Museum	1883
Bailey, F. M., F.L.S., ...	Gov. Botanist, Brisbane, Q.	1881
Canham, J.	Stuart's Creek	1880
*Cloud, T. C., F.C.S.	Wallaroo	1881
Chandler, T.	Peake	1881
*Foelsche, Paul	Palmerston	1880
Goldstein, J. R. Y.	Melbourne	1880
*Hayter, H. H., M.A., C.M.G., F.S.S.	Government Statist, Melbourne	1878
Holtze, Maurice	Palmerston	1882
*Kempe, Rev. J.	Finke, MacDonnell Ranges ..	1880
*Richards, Mrs. A.	Fowler's Bay	1880
*Scoular, Gavin	Smithfield	1878
*Stirling, James, F.L.S.	Omeo, Victoria	1883
*Tepper, J. G. O., F.L.S.	Museum	1878
FELLOWS.		
*Adamson, D. B.	Angas-street	1867
Addis, W. L.	Currie-street, ...	1879
Angas, J. H.	Angaston	1874
Biggs, Col. J. H...	Edwardstown	1878
Black, A. B.	Exchange, Pirie-street ..	1882
Bowyer-Smyth, C., C.E.	Engineer-in-Chief's Office ..	1883
Brown, J. C., F.L.S.	Conservator of Forests, Adel.	1882
Brown, L. G.	Two Wells	1882
Browne, H. Y. L.	Gov. Geologist, Adelaide ..	1883
Brunskill, Geo.	Morgan, ...	1878

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Burchell, F. N.	Survey Office	1881
Campbell, Hon. A., L.R.C.P., Edin.	Adelaide	1882
Caterer, T. A., B.A.	Norwood	1882
*Chalwin, Thos., M.R.L.V.S. ..	Currie-street	1877
Chapple, F., B.A., B.Sc.	Prince Alfred College ..	1876
Cleland, W. L., M.B.	Parkside Asylum	1879
*(L)Cooke, E.	South Terrace	1876
Cox, W. C.	.. .. ..	1880
Cornish, W. H.	Survey Office	1883
Crawford, F. S.	Surveyor-General's Office ..	1865
*Davenport, S.	Beaumont	1856
Davies, Edward	Hutt-street	1882
Davis, F. W.	*Advertiser* Office	1882
Dobbie, A. W.	Gawler-place	1876
Driffield, F. S. C.	Waymouth-street	1883
Elder, Sir Thomas	Grenfell-street	1871
Evans, Thomas	Adelaide	1883
Farrar, G. E.	Adelaide	1883
*Fletcher, Rev. W. R, M.A. ..	Kent Town	1876
Florance, W.	.. .. ..	1881
Foote, H.	Outalpa	1883
Fowler, W.	Yarroo, Kulpara	1882
Gall, D...	Tynte-street, North Adelaide	1865
Gardner, W., M.D.	Adelaide	1882
Gee, Lionel, C.E.	Survey Office	1882
Giles, Geo. F.	General Post Office ..	1883
Gill, H. C.	S.A. Institute	1883
Grundy, E. B.	Adelaide	1882
Gosse, Charles, M.D.	Adelaide	1877
*Goyder, Geo., jun.	Government Offices ..	1880
*Haacke, Wm., Ph.D.	Director S.A. Museum ..	1882
Harris, T. W.	*Register* Office	1882
Harris, C. H.	Survey Office	1883
Harrold, A. L.	Hindley-street	1876
Harry, Thomas	Exchange, Pirie-street ..	1878
*Haslam, John, C.E.	Adelaide	1883
Hay, Hon. Alexander	Beaumont	1861
Henry, Alexander, M.D.	Victoria-square	1882
Hopkins, Rev. W.	Glenelg	1880
Howchin, Rev. W., F.G.S. ..	*Christian Colonist* Office ..	1883
Hughes, H. W.	Booyoolie	1883
*Hullett, J. W. H.	Port Augusta	1876
Johnson, J. A.	Alfred Chambers	1875
*Joyce, J. F., M.R.C.S.	South-terrace	1880
*(r) Kay, R.	S.A. Institute	1853
Knevett, S.	Carrington-street	1878
*Lamb, Prof. H., M.A.	University	1883
*Laughton, E.	Currie-street	1874
Leary, J. W.	North-terrace	1883
*Lloyd, J. S.	Lefevre-terrace, N. Adelaide	1856
Madley, L. G., Principal of Training College	Whitmore-square	1879
Magarey, A. T.	Strangway's-terrace ..	1873
*Magarey, S. J., M.B.	Adelaide	1874
Mais, H. C., C.E.	Engineer-in-Chief's Office ..	1883
*Mann, Jas., L.R.C.P. *et* S. ..	Adelaide	1882
*Mayo, George, F.R.C.S.	Adelaide	1853
Mayo, G. G.	Engineer-in-Chief's Office ..	1874

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*Meyrick, E., B.A.	.. ..	Christchurch, N.Z. ..	1881
Middleton, W. J. C.	.. ..	Kangarilla	1882
Mohan, John Henry	.. ..	.. .. ..	1883
Molineux, A. ..	.. ..	Kent Town	1880
(L) Murray, David..	.. ..	North Adelaide	1859
Nesbit, E. Pariss, jun.	.. ..	King William-street ..	1875
Nesbitt, W. Peel, M.B.,	.. ..	North Adelaide	1880
Nickolls, J. ..	.. ..	New Zealand	1883
Parker, Thos., C.E.	.. ..	Port Adelaide	1883
Phillips, W. H. ..	.. ..	.. .. ..	1882
Pickels, W. E., F.R.M.S.	.. ..	Adelaide	1883
*Pollitzer, S. ..	.. ..	.. .. ..	1881
Poulton, B., M.B.	.. ..	Adelaide Hospital.. ..	1883
Rees, John, M.R.C.S.	.. ..	Hindmarsh	1880
Rees, Roland, M.P.	.. ..	North Adelaide	1874
Rigaud, R. J. ..	.. ..	*Register* Office	1882
Robertson, R., F.F.P.S.	.. ..	Adelaide	1882
Robin, R. B. ..	.. ..	Grenfell-street	1882
Rogers, Rev. N. ..	.. ..	Moonta	1882
Russell, W. ..	.. ..	Port Adelaide	1879
*Rutt, Walter, C.E.	.. ..	Engineer-in-Chief's Office ..	1876
Salom, Hon. M. ..	.. ..	North Adelaide	1881
*Schomburgk, R., Ph.D.	.. ..	Director of Botanic Gardens	1865
*Smeaton, Stirling, B.A.	.. ..	Engineer-in-Chief's Office ..	1882
*Smeaton, Thos. D.	.. ..	Bank of South Australia ..	1857
Smith, E. Mitchell	.. ..	Survey Department ..	1883
Smith, R. Barr ..	.. ..	Torrens Park, Mitcham ..	1871
Smith, William ..	.. ..	Hydraulic Engineer's Office	1880
Smyth, J. Y., B.A.	.. ..	Norwood	1882
Sparks, H. Y. ..	.. ..	Glenelg	1878
*Stirling, E.C., M.D., F.R.C.S.	..	North Adelaide	1881
Stuckey, J. J., M.A. ..	.. ..	Adelaide	1878
*Tate, Prof. R., F.G.S., F.L.S., &c.	..	University of Adelaide ..	1876
*Telfer, W.	.. ..	.. .. ..	1880
*Thomas, J. Davies, M.D., F.R.C.S.	..	Adelaide	1877
Shaw, William	..	Railway Department ..	1878
*Tietkins, W. H., F.R.G.S.	..	Millswood	1881
*Todd, Charles, C.M.G., F.R.A.S., &c.		Adelaide	1856
Tomkinson, Samuel ..	..	Adelaide	1876
Tyas, J. W.	..	University of Adelaide ..	1882
Umbehann, C.	..	General Post Office ..	1879
*Varley, A. K.	..	Mount Gambier	1883
*Verco, J. Cooke, M.D., F.R.C.S.	..	North Adelaide	1878
Vickery, G.	..	Meadows..	1868
Ware, W. L.	..	Adelaide	1878
Way, E. W., M.B., M.R.C.S.	..	Adelaide	1878
Way, S. J., Chief Justice ..	..	North Adelaide	1859
White, R. A.	..	Engineer-in-Chief's Office ..	1882
Whiting, John B. ..	..	Destitute Board Office ..	1882
*Whittell, H., M.D. ..	..	Glenelg	1882
Woodward, H. O. ..	..	Gov. Geologist's Office ..	1883
Wragge, C. L., F.R.G.S. ..	..	.. .. ..	1877
Wyatt, Wm., M.D. ..	..	Burnside	1859
Young, Wm., M.A. ..	..	Hindmarsh	1881

ASSOCIATE.

Burchell, D. ..	.. ..	Surveyor General's Office ..	1883

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